The Effect of Processing Mode on Intrusive Memories and Emotional Reactivity following Exposure to Trauma

An Experimental Analogue Study

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Main Research Project

The Effect of Processing Mode on Intrusive Memories and Emotional Reactivity following Exposure to Trauma: An Experimental Analogue Study.

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Abstract

Background and aims: Evidence suggests that the mode in which traumatic events are processed may influence the development of PTSD, although experimental evidence is lacking. It is crucial to discover what could potentially protect against the development of symptoms such as intrusive memories, since this would allow for the development of evidence-based prevention programmes for at-risk groups. Using a trauma film paradigm (Holmes & Bourne, 2008), the current study investigated the effect of processing mode training (abstract versus concrete) during exposure to an analogue trauma on the subsequent development of intrusive memories, the hallmark feature of PTSD. It also investigated its effect on emotional reactivity to a subsequent traumatic stimulus and whether potential vulnerability factors (e.g. rumination, dissociation, sleep problems, self-reported proneness to intrusions) were related to the frequency of intrusions developed.

Method: Fifty-one participants were trained to process traumatic films in an abstract or concrete mode. In the abstract condition, participants were trained to focus on the overall meaning and implications of the events and on questions such as 'Why?' and 'What if?' In the concrete condition, participants were trained to focus on contextual details and the sequence of events and on questions such as 'What?' and 'How?' Participants rated their emotional reactions to pre- and post-training test films. They then recorded in a diary the number of intrusive memories they experienced in relation to the film clips over the subsequent week and completed the Impact of Events Scale-Revised (IES-R; Weiss & Marmar, 1997) one week later.

Results: As predicted, participants in the concrete group reported fewer intrusive memories in response to the film clips over the subsequent week and lower IES-R scores compared with the abstract group. They also showed reduced emotional reactivity (distress and horror) in response to a post-training film clip although this did not extend to subjective ratings of arousal and negative affect. Self-reported proneness to intrusive memories and pre-existing sleep difficulties significantly predicted intrusive memories, whereas trait rumination and dissociation did not.

Conclusions: Overall, findings suggest that training people to adopt a concrete mode of processing during exposure to analogue trauma may protect against the development of intrusive memories and have important implications for the development of preventative programmes for at-risk occupational groups.

1. Introduction

1.1 Post-traumatic stress disorder

1.1.1 Definition

Post-traumatic stress disorder (PTSD) is a distressing and impairing anxiety disorder that develops in response to a traumatic event. In DSM-IV, a traumatic event is defined as one in which the person 'experienced, witnessed or was confronted with an event or events that involved actual or threatened death or serious physical injury, or a threat to the physical integrity of self or others, and the person's response involved intense fear, helplessness or horror'. PTSD is characterised by three core clusters of symptoms (APA, 1994). The first is *re-experiencing* of the event in the form of recurrent and distressing intrusive recollections (e.g. images, thoughts or perceptions, dreams), acting or feeling as if the event is re-occurring and intense psychological distress and physiological reactivity at internal and external cues that act as reminders. The second is *persistent avoidance* of stimuli associated with the event and numbing of general responsiveness (e.g. avoiding thinking or talking about the trauma and reminders of it). The third cluster is *increased arousal*, including difficulty with concentration, sleep and irritability. To meet criteria for PTSD, symptoms must have persisted for one month and cause impaired social and/or occupational functioning. In addition to these core symptoms, the traumatic event and its consequences are often associated with a range of emotions, such as guilt, shame and anger. PTSD is also associated with increased rates of major depressive disorder (including an increased risk of suicide), other anxiety disorders and substance misuse, causing further distress and disruption to functioning.

1.1.2 Intrusive memories

Persistent and distressing intrusive memories are the hallmark feature of PTSD, with studies showing them to be the most frequently endorsed symptom in response to a traumatic event (Durham *et al.*, 1985; Genest *et al.*, 1990). They are hypothesised to play a central role in the maintenance of the disorder (Ehlers & Clark, 2000), giving rise to additional symptoms such as hyperarousal and avoidance (Michael *et al.*, 2005). Intrusive memories tend to be vivid and

image-based, containing disjointed sensory and perceptual fragments of the trauma, which lack time perspective and context and are therefore experienced as if the event were happening all over again. They frequently correspond to worst moments of a trauma, accompanied by high levels of emotional distress, and are triggered by both internal and environmental cues (Ehlers *et al.*, 2004; van der Kolk & Fisler, 1995).

Intrusive memories themselves are a common everyday experience. Studies suggest that they occur approximately one to five times a day in non-clinical populations (Berntsen, 1996; Mace, 2005) and can be associated with positive as well as negative emotion. Holmes (2003) argued that intrusive memories in PTSD lie on a continuum with these normal everyday intrusions, although in PTSD they are more frequent, distressing and debilitating. Most people develop some initial PTSD symptoms such as intrusive memories after a traumatic event (O'Donnell *et al.*, 2007) and, according to Horowitz (1975), they constitute a normal response, reflecting a general stress-response tendency. It has been suggested that intrusive memories may even be adaptive, for example, by promoting communication and social support and reappraisal of the trauma (Shalev *et al.*, 1993; O'Donnell *et al.*, 2007). However, experiencing high levels of intrusive memories after a trauma has been found to predict PTSD at 12 months (O'Donnell *et al.*, 2007).

Intrusive memories are not unique to PTSD and have been implicated in the maintenance of other psychological disorders including depression (Brewin, *et al.*, 1996; Kuyken & Brewin, 1994; Reynolds & Brewin, 1999), social phobia (Hirsch *et al.*, 2004), agoraphobia (Day *et al.*, 2004), obsessive compulsive disorder (de Silva, 1986; Speckens *et al.*, 2007), body dysmorphic disorder (Osman *et al.*, 2004), psychosis (Morrison *et al.*, 2002), bipolar disorder (Mansell & Lam, 2004) and substance misuse (May *et al.*, 2004). Steel *et al.* (2005) suggested that similar cognitive processes may underlie the development of intrusive memories across disorders. Intrusive memories are particularly common among individuals with depression. Brewin *et al.* (1996) found that 86% of depressed individuals reported repetitive intrusive memories, which was comparable to the level experienced by those with PTSD and significantly higher than controls. Reynolds and Brewin (1999) compared the frequency and characteristics of intrusive memories reported by matched samples of participants with PTSD and depression. They found that although intrusive memories were slightly more common in those with PTSD, there was considerable overlap in the characteristics of the intrusive memories between the two groups. This is perhaps unsurprising given high levels of comorbidity and symptom overlap between

PTSD and depression and that intrusive memories, nightmares and physiological arousal are common responses to stressful life events such as bereavement (Reynolds & Brewin, 1999).

1.1.3 Prevalence of PTSD

Prevalence estimates of PTSD vary across studies and depend on characteristics such as sampling (e.g. specialist versus community, age group, geographical location) and assessment methods (e.g. criteria and measures used). Early studies using community population samples found rates of between 1 and 3% (Davidson *et al.*, 1991; Helzer *et al.*, 1987; Shore *et al.*, 1989) whereas higher prevalence rates have been reported in more recent studies (Breslau *et al.*, 1991; Kessler *et al.*, 1995; Resnick *et al.*, 1993; Stein *et al.*, 1997). In a large representative community sample in the USA, Kessler *et al.* (1995) found a lifetime prevalence of 7.8% and Breslau *et al.* (1991) found a lifetime prevalence of 9.2% among a large young urban sample. In a large US sample of adult women using structured telephone interviews, Resnick *et al.* (1993) found a lifetime prevalence of 12.3%. Higher prevalence rates found in later studies have been attributed to their use of DSM-III-R or DSM-IV rather than DSM-III criteria and being more inclusive in their definitions of traumatic events (Kessler *et al.*, 1995).

Estimated rates of *exposure* to traumatic events are substantially higher, ranging from 39% (Breslau, 1991) to 89.6% (Breslau *et al.*, 1998). Kessler *et al.* (1995) found that more than half of their sample had experienced at least one traumatic event in their lifetime, with many reporting two or three, which suggests that PTSD is not an inevitable consequence of trauma. The risk of developing PTSD appears to vary according to the type of event. For example, deliberate acts of interpersonal violence, particularly physical and sexual assault, are associated with an increased risk of PTSD compared with other accidents or disasters (Breslau *et al.*, 1991; Kessler *et al.*, 1995, Resnick *et al.*, 1993).

Studies consistently show that PTSD is more common among women than men (Breslau *et al.*, 1991; Kessler *et al.*, 1995; Perkonigg *et al.*, 2000; Stein *et al.*, 1997). Kessler *et al.* (1995) found that women were twice as likely to have a diagnosis compared with men (10.4% versus 5% respectively), which is consistent with Breslau *et al.* (1991) who found a lifetime prevalence rate of 11.3% for women and 6% for men. Men and women also differ in their experience of traumatic events, with men reporting higher levels of exposure (Breslau *et al.*, 1991; Kessler *et*

al. 1995; Stein *et al.*, 1997). Kessler *et al.* (1995) found that 60.7% of men reported at least one trauma compared with 51.2% of women. Men are more likely to experience physical attacks, combat, being threatened with a weapon, held captive or kidnapped, whereas women are more likely to experience rape, sexual molestation, childhood parental neglect and childhood physical abuse (Kessler *et al.*, 1995; Stein *et al.*, 1997). As well as experiencing more 'high impact' events, women show a greater risk of developing PTSD than men following the same event (Breslau *et al.*, 1991; Kessler *et al.*, 1995).

Studies have found evidence of sub-threshold variants of PTSD which do not meet full diagnostic criteria and are less impaired than those with full PTSD, yet cause clinically meaningful functional impairment. Stein *et al.* (1997) found a one-month prevalence rate of 3.4% for women and 0.3% for men in a large community sample. Sub-threshold PTSD is found to be particularly common in Vietnam War veterans who have exhibited levels of impairment that rivalled those of people with full PTSD (Kulka *et al.*, 1990; Weiss *et al.*, 1992).

1.1.4 Occupational groups at risk of developing PTSD

Increased rates of PTSD symptoms, such as intrusive memories, have been found in certain occupational groups who are regularly exposed to trauma; such as people working in military and emergency services. Emergency service workers, particularly ambulance workers, attend to potentially traumatic events, such as road traffic accidents, suicides or cot deaths, every day. Thompson & Suzuki (1991) studied forty experienced ambulance workers selected randomly from the London Ambulance Service. The sample scored highly on the intrusion scale of the Impact of Events Scale (Horowitz *et al.*, 1979) and 60% showed signs of 'probable psychological distress'. In a systematic review, Sterud *et al.* (2006) found that out of seven studies looking at PTSD among ambulance workers, five showed prevalence rates of over 20%.

1.1.5 Comorbidity and course

PTSD is frequently associated with other psychological disorders. Lifetime comorbidity rates range from 62% to 92% and strong associations have been found with affective, anxiety and substance use disorders (Breslau *et al.*, 1991; Davidson *et al.*, 1985; Helzer *et al.*, 1987; Kessler

et al., 1995; Perkonigg *et al.*, 2000). Kulka *et al.* (1990) found that 98.8% theatre veterans with PTSD had some other DSM-III-R disorder compared with 40.6% of those without.

The onset of PTSD usually occurs in the first month of the trauma, although a minority (fewer than 15%) experience a delay in onset of months or years (McNally, 2005). Whereas a high proportion of people exhibit symptoms of PTSD soon after a trauma, a substantial proportion recover naturally in the following years without treatment, with a steep decline in PTSD rates occurring during the first year (e.g. Breslau *et al.*, 1991; Kessler *et al.*, 1995). However, it is estimated that in at least a third of cases, PTSD persists for three years or longer.

1.1.6 Summary of PTSD

PTSD is relatively common in the general population and occurs more frequently among females and occupational groups who are routinely exposed to trauma. Prevalence rates of sub-threshold symptoms, which cause clinically meaningful distress and impairment, are also higher in these groups. PTSD is frequently comorbid with other disorders such as depression, substance misuse and other anxiety disorders. Rates of exposure to traumatic events in the general population are high and whilst many people develop initial symptoms, the majority recover naturally whilst a third go on to develop persistent PTSD. This has stimulated interest in understanding how PTSD develops after exposure to a traumatic event and has led to the development of psychological theories and models aimed at explaining its development and maintenance.

1.2 Psychological theories of PTSD

Several theories of PTSD have been developed (for a review, see Brewin & Holmes, 2003). The most influential theories will be reviewed here and include: emotional processing theory; (Foa & Rothbaum, 2001; Foa *et al.*, 1989); dual representation theory (Brewin *et al.*, 1996); and Ehlers and Clark's (2000) cognitive model.

1.2.1 Emotional processing theory

Emotional processing theory (Foa & Rothbaum, 1998; Foa *et al.*, 1989) stemmed from the fear network model of PTSD (Lang, 1979), which proposes that the memory of a traumatic event comprises stimulus, fear and response nodes, and the connections between them. Activation of this network results in hypervigilance, intrusive re-experiencing and consequent avoidance. Foa & Rothbaum (1998) elaborated on this model and argued that the traumatic event interacts with an individual's prior beliefs about safety and personal competence. Foa & Rothbaum (1998) argued that individuals with more rigid pre-trauma views would be more vulnerable to PTSD, as the event may shatter previous positive beliefs (e.g. 'the world is safe place', 'I am competent') or confirm previously held negative beliefs (e.g. 'the world is a dangerous place', 'I am incompetent'). This interaction may be reinforced by other negative appraisals of the event or of the individual's response to it. These problematic appraisals lead to a low threshold of activation of the fear memory network, which is activated by a wide range of cues and triggers and dominates other experiences of safety and competence. This prevents the individual from receiving disconfirming evidence and the memory fails to be incorporated into existing knowledge structures.

1.2.2 Dual representation theory

Dual representation theory (Brewin *et al.*, 1996; 2001) proposes that traumas are processed via two separate memory systems: a verbally accessible memory (VAM) system and a situationally accessible memory (SAM) system, resulting in two distinct representations of the event. VAM representations contain verbal narrative memories of the trauma including rich contextual information such as time. They result from higher-level conscious processing of the event, forming a memory of it which is integrated into autobiographical memory and can later be deliberately retrieved. SAM representations contain sensory and image-based memories resulting from lower-level perceptual processing of the trauma, which have received insufficient attention to be incorporated into the VAM system. Because these memories lack higher-level verbal and contextual information (e.g. time code), they are poorly integrated into autobiographical memory and poorly discriminated from other memories and experiences. They are therefore difficult to retrieve deliberately and communicate to others and instead are accessed automatically through exposure to cues and reminders, which trigger re-experiencing of images and emotional responses.

According to Brewin *et al.* (1996), a balance of both verbal and perceptual processing is needed for functional processing of trauma and detailed VAM representations are needed to block automatic unwanted SAM representations from intruding into consciousness. PTSD symptoms therefore arise from a shift in processing balance away from VAM processing towards SAM processing, leading to insufficiently formed verbal representations needed to block automatic unwanted lower-level sensory representations from intruding into consciousness. For example, if an individual experiences a car crash, high levels of anxiety and the rapid unfolding of the trauma may prevent them from being able to process meaning of the situation and narrow attention to sensory stimuli such as approaching car headlights, which may be later re-experienced as an intrusive image.

1.2.3 Ehlers and Clark's (2000) cognitive model

Ehlers and Clark (2000) synthesised and elaborated on previous theories to provide a cognitive-behavioural account of the development and persistence of PTSD (see Figure 1). According to their model, PTSD arises when individuals process information relating to trauma in a way that signifies current threat, even though the event is in the past. This results from two key processes: 1) excessively negative appraisals of the trauma and/or its sequelae and 2) a disturbance in autobiographical memory of the event, which is poorly elaborated and contextualised. The first process includes overgeneralisations of danger or overestimating the likelihood of further trauma (e.g. 'bad things always happen to me', 'the world is unsafe'), or negative appraisals of one's own feelings and behaviour during the event (e.g. sexual arousal during a rape trauma). Negative appraisals of the sequelae may include appraisals of symptoms (e.g. 'having intrusions means I'm going mad'), of the consequences on their life (e.g. physically, socially and financially) and of other people's reactions.

The second process proposed to maintain a sense of current threat involves a disturbance in the autobiographical memory of the event, which is poorly elaborated and contextualised and therefore not integrated into autobiographical knowledge. As a result the individual is 'unable to see the trauma as a time-limited event that does not have global negative implications for their future' (Ehlers & Clark, 2000, p.320). Similar to Brewin *et al.* (1996), they highlighted the role of peri-traumatic cognitive processing and argued that functional processing of a trauma requires a balance of two processing styles, distinguishing between *conceptual* processing (focusing on meaning, organising information and placing it in context) and *data-driven*

processing (encoding of sensory impressions, such as smells and light at the time of the trauma). According to Ehlers and Clark (2000), a shift in information processing during the trauma away from conceptual processing towards data-driven processing prevents the formation of a coherent narrative, resulting in a disjointed unorganised memory which is easily triggered by cues.

Ehlers and Clark (2000) proposed a reciprocal relationship between the memory disturbance and appraisals, whereby the distorted memory reinforces dysfunctional appraisals (e.g. about the sequence of events and one's own and others' responses), which in turn precludes the accessing of inconsistent information. The resulting symptoms of re-experiencing and hyperarousal motivate dysfunctional cognitive and behavioural coping strategies (e.g. avoidance, thought suppression and rumination), which aim to reduce distress in the short term but paradoxically maintain perceived threat. These strategies may exacerbate symptoms directly (e.g. triggering intrusive memories) or indirectly (e.g. preventing change in appraisals or the elaboration and integration of the trauma memory).

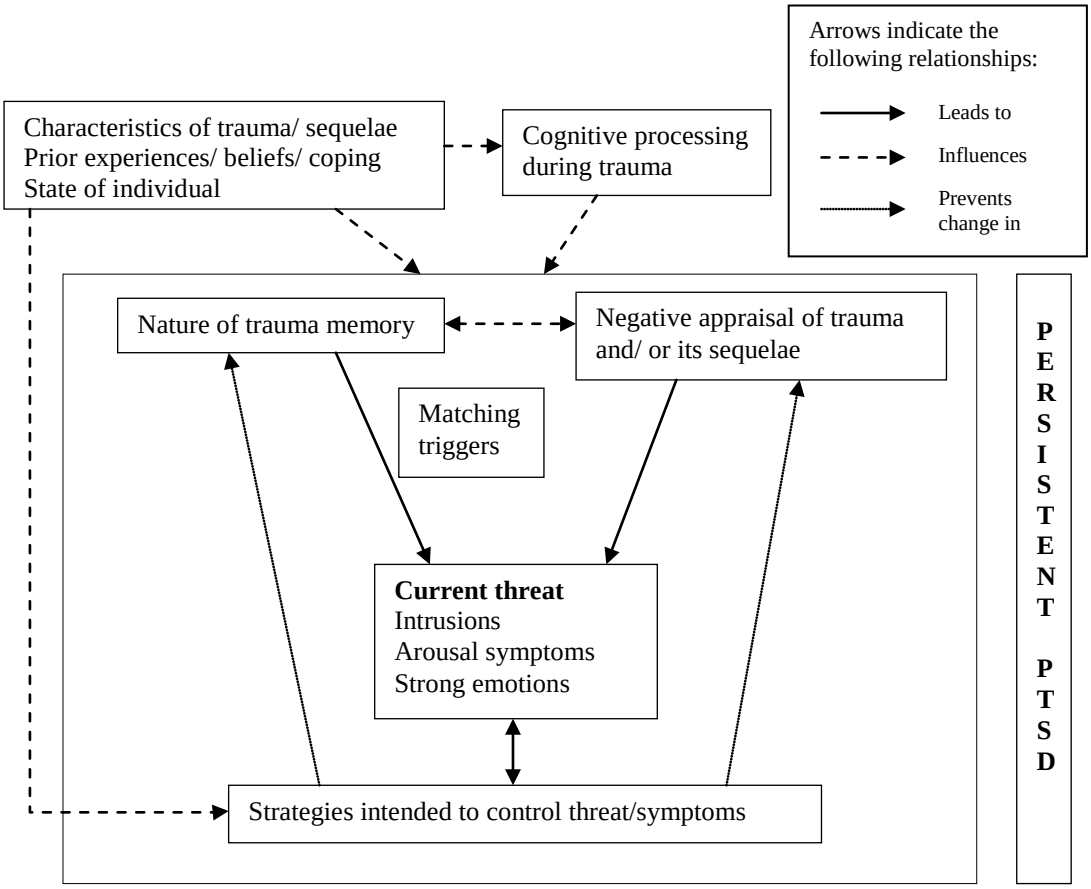

Figure 1. Ehlers and Clark's (2000) cognitive model of PTSD.

1.2.4 Summary of psychological models

Although psychological models of PTSD differ in their emphasis on hypothesised mechanisms relevant to the development of the disorder, there is a high degree of overlap. For example, all three models implicate the role of encoding mechanisms, memory processes, appraisals and coping strategies and prior beliefs (Brewin & Holmes, 2003). All three theories agree that exposure to the trauma through reliving facilitates the elaboration and contextualisation of the trauma memory. Dual representation theory and Ehlers and Clark's (2000) model overlap in their account of the role of peri-traumatic cognitive processing in the development of intrusive memories. Both theoretical accounts posit that a balance of sensory-perceptual and verbal-conceptual processing is required for functional processing of a trauma whereby verbal-conceptual processing allows the meaning of the trauma to be processed, for the memory to be organised and placed in context, so preventing sensory fragments, which lack time code, from intruding involuntarily into consciousness. Both argue this imbalance can be caused by an extreme emotional response to the event (e.g. fear and anxiety) or the speed at which the trauma unfolds allowing little time for conceptual processing. Ehlers and Clark (2000) elaborated on existing theories explaining how PTSD symptoms are maintained and why symptoms persist in a subset of individuals.

1.3 Psychological interventions for PTSD

Ehlers and Clark's (2000) model stipulates that effective treatment for persistent PTSD involves the elaboration and integration of the trauma memory into autobiographical memory to reduce intrusive re-experiencing (through imaginal exposure and reliving) and modifying problematic appraisals and coping strategies. Their model gives clear implications for cognitive behavioural therapy (CBT) for PTSD. This typically involves providing psychoeducation and a rationale for treatment, exposure (imaginal or in vivo) and cognitive restructuring, in order to elaborate the trauma memory and modify dysfunctional appraisals and coping strategies. Another established treatment for PTSD is Eye Movement Desensitisation and Reprocessing (EMDR; Shapiro, 1989), which also aims to integrate the trauma memory into autobiographical memory and shares some features with CBT.

The effectiveness of CBT for PTSD is well established (e.g. American Psychiatric Association, 2004; Australian Centre for Posttraumatic Mental Health, 2007; Foa *et al.*, 1998; National Institute of Clinical Excellence, 2005). A meta-analysis of randomised controlled trials carried out by the Department of Health concluded that both trauma-focused CBT and EMDR showed clinically important benefits on PTSD symptoms over waiting-list and other supportive and non-directive treatments. The evidence is strongest for CBT (NICE, 2005). NICE (2005) recommend that all sufferers should be offered a course of CBT or EMDR.

Despite the success of CBT and EMDR in treating persistent PTSD, early interventions aimed at preventing the development of PTSD symptoms following trauma (e.g. intrusive memories and related distress) are lacking. Early intervention and prevention of PTSD symptoms is particularly relevant for at-risk occupational groups such as emergency service workers, journalists working in conflict zones, and military personnel, who are regularly exposed to trauma. A type of early intervention known as 'debriefing' was developed to help people cope with the immediate psychological aftermath of a trauma, aimed at accelerating recovery through support, education about traumatic stress, expressing emotions and making plans for the future. This may include a single individual session or multi-component group programmes consisting of pre-trauma training, a group debriefing meeting, follow-up and case management ('Critical Incident Stress Management'; Mitchell & Everly, 1997). Evidence suggests that individual, single session debriefing is ineffective in preventing the development of PTSD and may even be harmful in certain cases (Van Emmerik *et al.*, 2002; NICE, 2005; Rose *et al.*, 2004). However, reviews have mainly focused on single session interventions and there is a shortage of methodologically sound studies investigating group debriefing and multi-component programmes (NICE, 2005).

1.3.1 Summary of psychological interventions

The effectiveness of interventions for persistent PTSD is well established. However, early interventions aimed at preventing its development are lacking. Such interventions are particularly relevant for occupational groups who are at increased risk of developing PTSD. Preventative interventions may be informed by research into factors associated with the development of PTSD symptoms such as intrusive memories.

1.4 Factors linked to the development of PTSD

A vast number of studies have revealed factors linked to the development, severity and persistence of PTSD. Understanding such factors is important in identifying individuals at risk (e.g. through screening measures) and informing the development of prevention or early intervention programmes for vulnerable individuals. Correlational findings (from both cross-sectional and prospective longitudinal studies) will be reviewed first and can be categorised into pre-trauma, peri-traumatic and post-trauma factors. This will be followed by a review of experimental studies which investigate the causal role of such factors in the development of PTSD.

1.4.1 Pre-trauma factors

Pre-trauma vulnerability factors linked to PTSD include demographic variables and psychological factors such as personality traits or coping styles. Demographic factors include female gender (Breslau *et al.*, 1991; Kessler *et al.*, 1995; Perkonigg *et al.*, 2000), younger age, low social class, place of residence and number of previous traumatic events (e.g. Perkonigg *et al.*, 2000), early separation from parents (Breslau *et al.*, 1991), lower intellectual ability, history of psychiatric disorder (Davidson *et al.*, 1991; McFarlane, 1989; Resnick *et al.*, 1993) and family history of anxiety (Breslau *et al.*, 1991). Breslau *et al.* (1991) also emphasised lifestyle factors associated with increased risk of exposure to traumatic events as an indirect risk factor for developing the disorder.

Individual psychological characteristics associated with PTSD include neuroticism (Breslau *et al.*, 1991; McFarlane, 1989), pre-existing anxiety or depression, pre-trauma depressive rumination (Nolen-Hoeksema & Morrow, 1991) and an avoidant coping style (Bryant & Harvey, 1995). Davies and Clark (1998b) investigated whether participants' subjective ratings of their proneness to intrusive cognitions in everyday life predicted the number of intrusive memories they developed in response to a traumatic film. As predicted, a higher self-reported tendency to experience intrusions was associated with a higher number of intrusive memories in response to the film.

Although it is well established that sleep disturbance is a consequence of PTSD, due to intrusive symptomatology (e.g. nightmares and intrusive images) and hyperarousal symptoms, pre-trauma sleep difficulties have also been implicated in the development and maintenance of PTSD (Mellman *et al.*, 1995). Mellman *et al.* (2005) found that among survivors of Hurricane Andrew, greater pre-trauma sleep difficulties rated retrospectively following a trauma predicted the development of PTSD.

1.4.2 Peri-traumatic factors

Peri-traumatic factors implicated in the development of PTSD include characteristics of the event itself and cognitive and affective processes operating at the time. Characteristics such as the duration and predictability of the trauma may be important (Ehlers & Clark, 2000), as well as the type of event (e.g. Breslau *et al.*, 1991; Kessler *et al.*, 1995). Affective processes linked to PTSD include high levels of peri-traumatic anxiety and distress (Davies & Clark, 1998a; Laposa & Alden, 2006; Regambal & Alden, 2009; Rothbaum *et al.*, 1992).

Cognitive factors operating at the time of the event are emphasised in psychological models of PTSD (e.g. Brewin *et al.*, 1996; Ehlers & Clark, 2000) and have received considerable research attention. Peri-traumatic cognitive factors associated with increased risk of PTSD include greater appraisals of threat (March, 1993; Solomon *et al.*, 1989), mental defeat (Dunmore *et al.*, 1997), data-driven processing (Ehlers *et al.*, 2003, 2010; Evans *et al.*, 2007; Halligan *et al.*, 2003; Murray *et al.*, 2002), lack of self-referent processing (Halligan *et al.*, 2003; Evans *et al.*, 2007) and dissociation (Weiss *et al.*, 1995).

1.4.3 Post-trauma factors

Studies of post-trauma factors have looked at the role of initial symptoms, appraisals of the trauma and its sequelae and cognitive and behavioural coping strategies. Although mild symptoms are common following a traumatic event, they do not predict later PTSD whereas high levels of initial re-experiencing, avoidance and arousal symptoms a week after the trauma have been found to predict PTSD at 12 months (O'Donnell *et al.*, 2007).

Studies have also consistently found that excessively negative appraisals of the trauma, initial symptoms and trauma-induced changes in self are associated with severity and persistence of PTSD (Bryant & Guthrie, 2007; Clohessy & Ehlers, 1999; Dunmore *et al.*, 1997; Ehlers *et al.*, 1998; Ehlers & Steil, 1995) even when controlling for intrusion frequency (Steil & Ehlers, 2000).

A number of post-traumatic cognitive and behavioural coping strategies have been investigated. Rumination is a strong predictor of PTSD maintenance (Ehlers *et al.* 1998; Ehring *et al.*, 2008; El-Leithy *et al.* 2006; Laposa & Rector, 2012; Nolen-Hoeksema and Morrow, 1991). Other strategies associated with PTSD include high levels of initial avoidance (Lawrence *et al.*, 1996), efforts to suppress memories of the trauma (Ehlers *et al.*, 1998), suppression of emotions over a long period of time (e.g. Joseph *et al.*, 1997), mental disengagement (cognitive avoidance), wishful thinking (correcting the past in fantasy; Clohessy & Ehlers, 1999) and counterfactual thinking (imagining how things could have turned out differently; Callander *et al.*, 2007; Clohessy & Ehlers, 1999; Ehlers *et al.* 1998b; El Leithy *et al.*, 2006; Steil & Ehlers, 2000). An association has also been found between PTSD and compensation claims and PTSD and physical injury (NICE, 2005). Clohessy and Ehlers (1999) identified coping styles that were more helpful after a traumatic event, which include disclosure (Pennebaker & O'Heeron, 1984), understanding and making sense of trauma (Silver *et al.*, 1983) and use of social support (Jones & Barlow, 1990).

As well as pre-trauma sleep factors being a potential vulnerability factor (Mellman *et al.* 1995), sleep complaints one month after a trauma have been found to significantly predict PTSD at 12 months (Koren *et al.*, 2002). Furthermore, Krakow *et al.* (2001) found that a sleep-focused intervention was associated with an improvement in PTSD symptoms. This suggests that sleep disturbance after trauma may also be a risk factor.

1.4.4 Meta-analyses of factors linked to PTSD

Two key meta-analyses have attempted to synthesise the wide range of findings of factors linked to PTSD symptoms and severity. Brewin *et al.* (2000) looked at 14 risk factors from 77 articles. These included: female gender; younger age; greater social, educational and intellectual disadvantage; race (minority status), psychiatric history; childhood abuse and

adversity; previous trauma; family psychiatric history; trauma severity; lack of social support and life stress. They found that peri- and post-traumatic factors (e.g. trauma severity, lack of social support, additional life stress) were stronger predictors than pre-trauma factors. Significant moderating effects were found for study design, samples and measures used, therefore Brewin *et al.* (2000) cautioned against a general vulnerability model which assumes effect sizes will be constant across all samples (e.g. both civilian and military). They advocated a more dynamic model whereby, for example, peri-traumatic factors (e.g. cognitive processes) may interact with pre-trauma factors in determining risk of PTSD.

Ozer *et al.* (2003) also synthesised findings from 68 studies looking at seven predictors, including: prior trauma and psychological adjustment; family history of psychopathology; perceived life threat during the trauma; post-trauma social support; peri-traumatic emotional responses; and peri-traumatic dissociation. All were significant predictors of PTSD. Consistent with Brewin *et al.* (2000), Ozer *et al.* (2003) found that peri-traumatic factors (perceived threat during the trauma and dissociation), were better predictors of PTSD symptoms than historical or static characteristics (e.g. prior trauma, prior adjustment and family history of psychopathology).

1.4.5 Summary of correlational studies

A range of pre-, peri- and post-trauma factors have been linked to the development and persistence of PTSD symptomatology. Evidence suggests that peri-traumatic processes may be more important in the development of intrusive memories than pre-trauma factors and that both may interact to increase vulnerability. However, caution must be taken when interpreting the results of correlational studies as they often rely on retrospective reporting of variables that may lead to recall bias. Furthermore, the direction of causality is unclear. Experimental studies are needed in order to delineate factors that are causally involved in the development of PTSD symptoms such as intrusions, and to reduce bias associated with retrospective measures. As well as improving our understanding of factors causally linked to PTSD, experimental studies could inform interventions aimed at preventing these symptoms in vulnerable individuals.

1.5 Experimental studies of factors linked to PTSD: The trauma film paradigm

Despite the limitations of correlational studies, it is clearly unethical to expose people to real-life trauma in order to study these factors experimentally. A widely used experimental method of investigating factors linked to trauma exposure in an ethical way is the trauma film paradigm, which was pioneered by Lazarus *et al.* (1965) and later developed by Horowitz (1975). In this paradigm, participants are typically exposed to a film containing traumatic material (e.g. serious road traffic accidents, scenes of violence and death) under different conditions, and their responses (e.g. frequency of intrusive memories, avoidance and arousal) are measured. These studies have shown that PTSD and related symptoms such as intrusive memories can be induced in the laboratory, and their frequency increased or decreased by manipulating peri- or post-traumatic variables (see Holmes & Bourne, 2008 for a review).

1.5.1 Peri-traumatic processing

Verbal-conceptual versus sensory-perceptual processing

Studies adopting the trauma film paradigm have sought to investigate predictions of cognitive models, which hypothesise that intrusive memories result from a shift in information processing away from verbal-conceptual processing towards sensory-perceptual processing (e.g. Brewin *et al.*, 1996; Ehlers & Clark, 2000). Holmes *et al.* (2004) conducted a series of experiments aimed at manipulating verbal versus visuospatial processing by instructing participants to perform different concurrent tasks while watching a traumatic film. Based on dual representation theory, they predicted that performing a concurrent visuospatial task would reduce the number of intrusions experienced by competing with SAM processing of the trauma, whereas a verbal task would interfere with VAM processing and possibly lead to more intrusions.

As predicted, performing a visuospatial tapping task whilst watching the film resulted in significantly fewer intrusions over the following week compared with a no task control condition (study 1), whereas completing a concurrent verbal task (counting backwards in 3s) increased frequency of intrusions (study 2). Holmes and colleagues argued that performing a

visuospatial task resulted in poorer encoding of sensory-perceptual details by disrupting SAM processing, making them less likely to be accessed by reminders and less likely to intrude during the following week. Conversely, they argued that the verbal task disrupted encoding of verbal-narrative memories by impoverishing VAM processing, reducing their ability to suppress subsequent images and leading to more frequent intrusions. Similar results were found by Stuart *et al.* (2006) who used a within-subjects design showing that a different visuospatial task during an analogue trauma reduced intrusion frequency compared with a no task control, without affecting distress or dissociation. Holmes *et al.* (2009) extended these findings demonstrating that playing a visuospatial computer game (Tetris) *after* viewing the traumatic film reduced the frequency of intrusive memories over one week, whilst leaving memory recall intact.

Halligan *et al.* (2002) also sought to investigate whether promoting verbal-conceptual relative to sensory-perceptual processing of an analogue trauma would act as a protective factor against developing intrusions. Healthy participants were instructed to process a traumatic film in a conceptual way (e.g. 'focus on the story, follow what is happening to people and why and think about what might happen next') or a perceptual way ('watch the film whilst being absorbed in the images and sounds, viewing the scenes as unconnected snapshots'). Contrary to predictions, no significant differences were found between the two groups in number of intrusions experienced over the subsequent week. However, when they divided participants into trait conceptual or perceptual information processing style based on the Conceptual Processing Questionnaire (Ehlers, 1998), trait conceptual processing was positively correlated with number of intrusions experienced, distress and avoidance. This means that innate ability to process the meaning in an organised way (e.g. placing it in context) may lead to fewer intrusive memories after a traumatic event.

In two studies, Laposa and Alden (2006) interviewed emergency service workers to elicit coping strategies that were perceived to be the most effective in regulating emotions when dealing with traumatic situations (study 1) and manipulated healthy participants' use of these strategies using the trauma film paradigm (study 2). The most effective strategies reported were: attending to the mechanical steps of medical treatment, focusing on events and processes occurring in the here and now, and recalling and applying prior training to solve medical problems. Participants in the second study were asked to watch a video of real events in a hospital emergency room. The 'coping' group was asked to use the medical focus strategies (e.g. 'focus on the medical procedures being used by the medical staff and analyse what the staff

are trying to accomplish'), whereas the no strategy control group was asked to simply watch the events. As predicted, the coping group reported significantly fewer intrusions during the following week compared with controls. The authors inferred that these strategies facilitated verbal-conceptual processing, therefore promoting more functional processing of the trauma and protecting against the development of intrusive memories. This study has greater external validity than Holmes *et al.* (2004) as it involved generating an internal strategy rather than performing a concurrent task. However, given that the instructions were context-specific, the generalisability of these findings may be limited to professionals working in Emergency Rooms.

Dissociation

Dissociation is defined as 'a disruption of the usually integrated functions of consciousness, identity, or perception of the environment' (APA, 1994) and during trauma is characterised by feeling that the event is not really happening in reality, and feeling disconnected from one's body, feelings or environment. It is thought to interfere with adequate processing of the trauma, contributing to poor elaboration and contextualisation of the trauma memory (Ehlers & Clark, 2000). Although correlational studies suggest that peri-traumatic dissociation is associated with the development of PTSD symptoms, experimental studies that have attempted to induce peri-traumatic dissociation have failed to demonstrate an effect on the development of intrusive memories (e.g. Holmes *et al.,* 2004; Murray, 1997). However, these studies support correlational findings by showing that both trait (Murray, 1997) and state (Holmes *et al.,* 2004) dissociation were linked to intrusive memory development. Nevertheless, it has not yet been shown that dissociation leads to the development of intrusive memories. That is, the causal role of dissociation in the development of intrusive memories remains unclear.

1.5.2 Post-trauma factors

Avoidance and thought suppression

Davies and Clark (1998a) examined the impact of thought suppression on intrusive memories experienced following exposure to a traumatic film. In the two minutes following the film, participants were either asked to deliberately suppress their thoughts relating to the film or to

think freely about it. The frequency of intrusive memories in the subsequent two minutes was then recorded. Those who were asked to suppress their thoughts experienced a greater number of intrusive memories in the subsequent two minutes compared with those who were asked to think freely. This provides support for the role of thought suppression in the development of intrusive memories, although these were not measured over a longer period (e.g. a week).

Rumination and worry

Butler *et al.* (1995) investigated the effects of worrying about an analogue trauma after exposure. Worry is a verbal process, which has been conceptualised as a form of avoidance, which functions to reduce aversive imagery and thus prevent emotional processing of these images (Borkovec *et al.*, 1998). After viewing a traumatic film, participants were instructed to either worry about the film's contents during the subsequent four minutes, or to imagine visually the distressing aspects of it. As predicted, the worry group reported more intrusions over the subsequent three days than the imagery group. Similar results were found by Wells and Papageorgiou (1995) who found that worrying about an analogue stressor for a period of four minutes after exposure led to significantly more intrusions over the next three days compared with a 'settle-down' control condition.

1.5.3 Preventing intrusive memories using cognitive bias modification

In the wider field of research on the role of cognitive processes in the development and prevention of emotional disorders, another experimental method known as cognitive bias modification (CBM) has been developed. Cognitive models of emotional disorders propose that cognitive biases (also known as information-processing biases, thinking styles or errors or cognitive distortions) are involved in the onset and maintenance of emotional disorders (Beck, 1976; 1979). Mineka and Tomarken (1989) define cognitive biases as 'selective or non-veridical processing of emotion-relevant information'. Although these biases are evident across a range of disorders, the type or content appears to be disorder-specific and linked to emotion (for reviews see Mathews & MacLeod, 2005; Mineka & Sutton, 1992). For example, anxiety is associated with attentional biases towards threatening stimuli and depression is characterised by a memory bias for negative self-relevant material, although both are associated with

judgemental or reasoning biases such as overestimating the likelihood of certain negative events (Williams *et al.*, 1988).

CBM aims to systematically modify cognitive biases by training individuals (either implicitly or explicitly) to process events in a particular way which is consistent or inconsistent with a particular cognitive bias, with the aim that this will alter how those individuals process similar events in the future. As well as testing predictions from cognitive models about the causal role of such biases in the aetiology of emotional disorders, this provides a method of potentially reducing vulnerability to emotional distress by training individuals to naturally generate more functional biases or appraisals.

Mathews and Mackintosh (2000) originally used this paradigm to implicitly train healthy participants over a series of trials to process ambiguous scenarios in a benign or threatening way. Participants were exposed to ambiguous scenarios with the meaning (positive or negative) only becoming apparent in the final word in the event description. For example, 'Getting ready to go you think the new people you meet will find you (boring/friendly)', with the final word presented as a word fragment that participants had to complete. The authors then presented participants with novel scenarios and found that participants who had undergone negative training continued to process events in a negative way and demonstrated increased anxiety reactivity in response to a later stressor compared with those who had undergone positive training. In another study, Wilson *et al.* (2006) found that those who acquired negative biases demonstrated increased anxiety reactivity in response to a later stressor despite no effect of training on mood state, providing further support for the causal role of negative biases in the development of anxiety. Yiend *et al.* (2005) found that experimentally acquired negative cognitive biases could endure for several days and Holmes *et al.* (2006) demonstrated that participants could also be trained to adopt positive appraisals.

Studies looking at the causal role of information processing biases in the development of intrusive memories and PTSD have combined trauma film and CBM paradigms. This involves training people to process analogue traumatic events or their sequelae in a manner which is consistent or inconsistent with that typically associated with PTSD and investigating subsequent responses. Woud *et al.* (2011) assigned participants to either positive or negative appraisal training after viewing a traumatic film. Training targeted beliefs about self-efficacy and appraisals of responses to the film (e.g. emotions and intrusive memories). An implicit,

computerised procedure was used whereby participants were presented with ambiguous sentences, the meaning of which participants had to resolve by completing an unambiguous word fragment. Participants in the negative training condition were trained to use maladaptive appraisals associated with PTSD (Foa *et al.*, 1999), for example, 'In a crisis I predict my responses will be u_el_ss'. Those in the positive training condition were trained to use the opposite, adaptive counterparts: 'In a crisis I predict my responses will be h_lpf_l'. Over one week, participants in the positive condition reported less frequent and less distressing intrusive memories, as well as lower scores on the Impact of Events Scale-Revised (Weiss & Marmar, 1997), than those the negative condition.

A similar design was used by Lang *et al.* (2009) who manipulated appraisals of depressive intrusions after watching a depressive film (scenes of bereavement and bullying), using a computerised implicit CBM paradigm. Participants read a series of statements on a computer screen. Again, the sentences remained ambiguous and the meaning (positive or negative) was only resolved by the word fragment ('Having intrusions means s_mething's wrong with me', or 'Having intrusions means that n_thing is wrong with me'). Again, participants who underwent positive CBM showed a more positive interpretation bias in a recognition test, reported fewer intrusive memories of the film and had lower scores on the Impact of Events Scale (Horowitz, 1979) one week later.

CBM studies have typically used implicit induction of interpretative biases, for example, by resolving the meaning of an ambiguous stimulus with a word fragment. In a series of studies, Schartau *et al.* (2009) used a novel approach investigating the effect of explicitly training individuals to generate functional appraisals whilst watching a series of traumatic films. They first identified broad dysfunctional appraisal themes representative of those found across emotional disorders (e.g. anxiety and depression) and used these to generate functional appraisal themes, which were linked to seeing 'the bigger picture' (e.g. 'bad things happen', 'silver lining', 'broader perspective' and 'time heals'). In three studies, healthy participants were trained to apply specific functional appraisals based on these themes to a series of traumatic training films, and their emotional reactions to pre- and post-training test clips were compared with controls, who were simply asked to watch the film without trying to control their emotions in any way.

In the first study, participants who underwent appraisal training exhibited reduced levels of self-reported negative emotion (distress and horror) and psychophysiological responses between pre- and post-training which were greater than the controls'. In the second study, they found the same effect when participants appraised after rather than during the film. In a third study, they replicated this effect and found that the appraisal group showed reduced emotional reactivity compared with controls and an additional 'detachment' control group. Importantly, in a fourth study, they investigated the effects of appraisal practice on recalling distressing autobiographical memories and included participants with higher levels of depression and anxiety. They found a significantly reduced number of intrusions and related avoidance of the target memories in the week post-study, compared with a non-significant effect in controls.

1.5.4 Summary of experimental studies

The trauma film paradigm provides an ethical way of testing hypotheses about the causal role of certain processes in the development of intrusive memories. Studies employing this paradigm have provided support for the role of peri-traumatic and post-traumatic factors implicated in psychological models of PTSD (including verbal-conceptual versus sensory-perceptual processing, thought suppression and worry). The trauma film paradigm can be combined with a cognitive bias modification procedure whereby individuals are trained to process analogue traumatic events and their sequelae in a way that is either consistent or inconsistent with a particular cognitive bias. Studies using this method have shown that training healthy individuals to process traumatic scenes in a manner consistent with PTSD (e.g. using maladaptive appraisals of emotional reactions and symptoms) increases the number of intrusive memories, whereas training individuals in more functional appraisals (e.g. of the trauma and it's sequelae) reduces distress, horror and physiological arousal, and protects against the development of intrusions.

1.6 Processing mode and the development of intrusive memories

1.6.1 Processing mode theory

In recent decades, a growing body of research has suggested that, in addition to content, the mode or style in which people think about negative events is an important factor in determining outcomes such as mood and intrusive memories (e.g. Watkins, 2008). This theory emerged partly from studies showing that rumination and worry are implicated in the onset and maintenance of a range of axis one disorders, including PTSD (Ehring & Watkins, 2008; Harvey, 2004). Both rumination and worry are types of repetitive negative thinking, and evidence suggests that repetitive negative thinking can be constructive or unconstructive, depending on the mode of processing adopted (Watkins, 2008).

Various authors have made a distinction between abstract and concrete modes of processing (Carver & Scheier, 1990; Stöber, 1998; Vallacher & Wegner, 1987; Watkins, 2008). Abstract processing is characterised by high-level construals of events, situations and behaviours. These tend to contain generalised and decontextualised mental representations conveying overall meanings of events and actions. They tend to consist of 'Why?' and 'What if?' questions that have no obvious solution and focus on desirability and importance of outcomes (e.g. 'Why did this happen to me?' 'What if things had been different?'). Concrete processing is characterised by lower-level construals, which contain contextual and specific details of events, situations and behaviours. They tend to consist of 'How?' questions and focus on direct experience (including emotions) and means to desired ends (e.g. steps needed to achieve an overall goal; Watkins, 2008).

The idea of concrete, low-level versus abstract, high-level construals stems from cognitive and social cognitive literature, which proposes that mental representations are organised hierarchically. Vallacher & Wegner, (1987) distinguished between low- and high-level 'identities' in the mental representation of actions. Low-level identities contain the specifics or details of the action, convey how the action is done and the means to an end, whereas high-level identities contain abstract representations which include general understanding of the action conveying why the action is done and what its effects or implications are. Similarly, Trope and colleagues distinguished between abstract high-level and concrete low-level construals (Trope

& Liberman, 2003) when perceiving objects and events or behaviour. For example, in perceptions of behaviour, high-level construals represent global and stable traits (e.g. 'laziness') whereas low-level construals refer to situation-specific states (e.g. 'tiredness'; Nussbaum *et al.*, 2003).

Watkins (2008) outlines evidence from cross-sectional, prospective longitudinal and experimental studies showing that, when thinking about negative content, an abstract-evaluative mode of processing leads to maladaptive outcomes on outcomes such as low mood. A concrete-experiential mode of processing on the other hand can be adaptive, for example, by facilitating emotional processing and recovery from upsetting events. Cognitive processes such as worry and rumination are characterised by an abstract mode of processing about negative events, which individuals tend to get stuck in. It is hypothesised that this process leads to dysfunctional outcomes across a range of disorders, even though the content may be disorder-specific (Ehring & Watkins, 2008; Harvey, 2004).

1.6.2 Theories of the effect of processing mode

Various theoretical accounts have been offered to explain why processing mode is important when thinking about negative events. One explanation is its effect on problem-solving. Vallacher and Wegner (1987) proposed that representations of goal-directed action contain high-level abstract representations of a goal or purpose and low-level action identities containing the specific details of an action and indicating the steps needed to achieve it. If representations of a goal are too abstract then this may impair performance and lead to negative mood (Vallacher & Wegner, 1987; Watkins, 2008). This idea is compatible with Stöber's (1998) reduced concreteness theory of worry. Stöber (1998) proposed that because worry is predominantly experienced in abstract-verbal form, it is less detailed and specific and therefore less amenable to problem-solving compared with concrete thinking about problems, which is detailed and specific and therefore facilitates the finding of potential solutions.

The second way in which processing mode may determine outcome is through its effects on emotional processing. In their interacting cognitive subsystems theory, Teasdale & Barnard, (1993) proposed that there are two different modes of self-focused attention with distinct functional properties: a propositional mode and an implicational mode, which correspond to

different levels of meaning. The propositional mode is concerned with processing language-based conceptual meanings and characterised by conceptual, evaluative thinking, focusing on discrepancies between current and desired outcomes. The implicational mode on the other hand is concerned with processing of implicit meanings derived from direct sensory experience and includes emotional as well as propositional information. According to this theory, effective emotional processing is facilitated at the implicational level, whereas it is hindered at the propositional level (Teasdale, 1999). This is also compatible with Borkovec's (1998) cognitive avoidance theory of worry. According to this theory, worry is a verbal process, which functions to avoid aversive imagery associated with feared outcomes. This has the effect of preventing emotional processing of these images, maintaining anxiety and distress.

It has also been argued that processing mode determines outcomes of thinking about negative events through its effect on self-regulation. For example, Leary *et al.* (2006) suggested that concrete thinking about problems or stressful events reduces self-focused attention and directs attention to the immediate environment, thereby reducing anxiety. They also argued that by focusing attention on the present environment and reducing abstract construals about the meaning and implications of situations, concrete construals may free up cognitive resources.

Another mechanism by which processing mode may improve self-regulation is by influencing the degree of generalisations formed from events (Watkins, 2008). Abstract processing fosters generalisations across events and situations and people. Whilst such generalisations can be adaptive (e.g. by deriving inferences and promoting learning across situations), negative overgeneralisations can be unhelpful and lead to distress (Hamilton *et al.*, 1993). These overgeneralisations reflect the types of cognitive bias seen in depression (Beck, 1976), where personal, global and stable generalisations are made about the self, world and the future (e.g. 'I am worthless', 'The world is unfair', 'The future is hopeless'). Overgeneralised appraisals are also hypothesised to play a role in the maintenance of PTSD, for example, 'The world is a dangerous place', 'I attract disaster' or 'My future is ruined'. Concrete processing may have more constructive effects by reducing unhelpful overgeneralisations and engendering more situation-specific and contextual appraisals.

1.6.3 Evidence for the role of abstract versus concrete processing in depression

Most of the empirical evidence for processing mode theory comes from studies of depression. In a series of studies, Watkins and colleagues have compared (a) an abstract, verbal analytical evaluative mode of processing consistent with depressive rumination in which participants are instructed to think about the causes, meanings and consequences of their symptoms and feelings and (b) a concrete-experiential mode inconsistent with the phenomenology of depressive rumination in which participants are instructed to focus attention on the experience of their symptoms and feelings. These studies have shown that the conceptual-evaluative variant reduced overgeneral autobiographical memory recall (Watkins & Teasdale, 2001; Watkins & Teasdale, 2004), reduced negative global self-evaluations (Rimes & Watkins, 2005) and improved social problem solving (Watkins & Baracaia, 2002; Watkins & Moulds, 2005).

Studies have also shown that processing mode influences emotional recovery after failure and emotional reactivity to upsetting events. Watkins (2004) exposed healthy participants to an induced failure task, which involved solving a series of reasoning problems, many of which were unsolvable. Participants were told this task was correlated with IQ. Following the task, they were assigned to writing about the failure experience in a conceptual-evaluative mode (consistent with an abstract mode of processing, e.g. 'Why did you feel this way?') or a concrete-experiential mode (e.g. 'How did you feel moment by moment?'). Those who wrote about the failure experience in a conceptual-evaluative mode demonstrated increased depressed mood, intrusive memories and avoidance about the failure experience 12 hours later compared with those who wrote about it in a concrete-experiential way.

Williams and Moulds (2010) investigated the effect of manipulating processing style on the experience of naturally occurring self-referent intrusive memories in dysphoric participants. Participants who underwent an analytical ruminative processing induction subsequently rated their intrusive memories as more negative, distressing, more evocative of a negative emotional response and reported more negative mood than participants in a distraction condition. However, the authors did not investigate the impact on the frequency of intrusive memories and only focused on intrusive memories within the session, without examining the effect on intrusive memories over a longer period. Furthermore, there was no concrete or experiential processing condition for comparison.

Using a CBM paradigm, Watkins *et al.* (2008) trained healthy participants to adopt specific modes of processing (i.e. abstract versus concrete). They asked participants to think about positive or negative scenarios in a mode either consistent or inconsistent with the abstract-evaluative mindset observed in depressive rumination, both via explicit instructions and via implicit induction of interpretative biases, before being exposed to a failure experience. Participants trained in the concrete mode, antithetical to depressive rumination, demonstrated less emotional reactivity following failure than participants trained in the mode consistent with depressive rumination. Watkins *et al.* (2009) extended this finding to dysphoric individuals and showed that concreteness training resulted in significantly greater decreases in depressive symptoms and significantly greater increases in concrete thinking than the waiting-list and a 'bogus training' control.

Studies have demonstrated that trait rumination can predict outcome although this depends on processing mode condition (Moberly & Watkins, 2006; Watkins, 2004; Watkins & Moulds, 2004). For example, both Watkins (2004) and Watkins and Moulds (2004) found that, after controlling for depression, high levels of trait rumination predicted greater increases in negative mood following failure in the conceptual-evaluative condition but not in the concrete-experiential condition.

1.6.4 The role of processing mode in the development of intrusive memories following trauma

Michael *et al.* (2007) investigated the mechanisms by which rumination maintains PTSD in assault survivors. They found that unproductive thoughts containing 'Why?' and 'What if?' questions indicative of abstract processing were both concurrently and prospectively associated with PTSD, and accounted for significantly more variance than solely the presence of rumination. Ehring *et al.* (2009) suggested that, like depressive rumination, dysfunctional forms of trauma-related rumination are also characterised by reduced levels of concreteness and that abstractness of thinking is important for the contribution of trauma-related rumination to the maintenance of PTSD symptoms such as intrusive memories. Drawing upon on the cognitive model of PTSD (Ehlers & Clark, 2000), they suggested that abstract rumination may prevent the elaboration of the trauma memory (e.g. to incorporate contextual details) and modification of negative appraisals, whereas concrete processing facilitates these. They also suggested that

abstract rumination may interfere with problem-solving, further contributing to the maintenance of PTSD symptoms.

Evidence suggests that processing mode is causally involved in the development of emotional reactivity and intrusive memories in depression, which shares common cognitive processes with PTSD (Reynolds & Brewin, 1999). Like depression, PTSD is characterised by abstract, overgeneralised appraisals (e.g. 'the world is a dangerous place', 'I attract disaster'). Another similarity in cognitive processing between depression and PTSD is overgeneral recall, which is the inability to retrieve specific autobiographical memories and instead tending to recall memories relating to collection of events or a time period. This is a well-established processing bias in depression (Kuyken & Brewin, 1995) and has also been demonstrated in individuals with PTSD (McNally *et al.*, 1994, 1995).

Ehring *et al.* (2009) used the trauma film paradigm to test the hypothesis that the abstractness of thinking is responsible for the dysfunctional effects of trauma-related rumination by looking at its impact on mood and intrusive memories. They assigned healthy participants to abstract rumination, concrete thinking or distraction conditions after watching a traumatic film containing scenes of the aftermath of serious road traffic accidents (RTAs). In the abstract rumination condition, participants were presented with questions on a computer screen and asked to think about them, such as 'Why do so many accidents have to happen?', 'Why do people have to drive so recklessly?' and 'Would I ever be able to get over it?'. In the concrete condition, they were asked to think about questions such as 'What are the reasons for accidents happening?', 'What factors contribute to the roads being dangerous?' and 'Which consequences would such an accident have on my life?' Results showed that abstract rumination led to significantly longer maintenance of negative mood and arousal than both concrete thinking and distraction, although the hypothesis that abstract rumination would lead to an increase in intrusive memories was not supported. Unexpectedly, the distraction group showed the highest number of intrusions whereas the abstract and concrete conditions did not significantly differ. However, only participants in the concrete thinking condition, but not those in the abstract one, reported significantly fewer intrusive memories than controls, which was interpreted as indirect evidence for the idea that concrete thinking is more functional than abstract thinking. The lack of difference between the two groups may have been due to the concrete instructions being insufficiently concrete, as questions about the reasons for accidents happening may have overlapped with 'Why' questions. It may also be due to manipulating processing modes (abstract versus concrete) after rather than during the analogue trauma.

Zetsche *et al.* (2009) compared the effects of abstract rumination and memory integration on mood and intrusive memories. They randomly assigned healthy participants to a guided thinking task designed to induce either rumination, memory integration or distraction after exposure to an analogue stressor (video of the aftermath of serious RTAs). Again, the ruminative sentences were chosen to resemble the form ('Why' and 'What if') and content of ruminative thoughts reported by RTA survivors with PTSD. In the memory integration condition, participants were asked to think about their experience of the film in a self-referent and chronological way (e.g. linking the experience of the video to the chronological sequence of events that day and distinguishing the video from their own non-traumatic experiences with road traffic), with questions adapted from a writing task used by Michael and Ehlers (2007). This aimed to promote the elaboration and integration of the memory into autobiographical memory and resembled a concrete mode of processing. The control condition involved distracting participants from thinking about the video whilst demanding a similar amount of concentration and verbal activity as the other two tasks (e.g. answering quiz questions). Consistent with Ehring *et al.*'s (2009) findings, rumination led to less recovery from sad mood triggered by the video than the other two conditions, although there was no differential effect of condition on intrusive memories. However, they found that self-reported levels of rumination during the guided thinking task predicted subsequent intrusive memories in the session. They interpreted this as correlational evidence supporting the link between rumination and intrusive memories.

1.6.5 Summary of processing mode theory

Processing mode theory holds that the mode or style of thinking about negative events can determine the effect it has on subsequent mood and memory features. Experimental studies of depression have demonstrated that a concrete mode of processing leads to reduced negative mood, promotes faster recovery from upsetting events, reduced emotional reactivity to future failure and reduced frequency of intrusive memories compared with an abstract mode. There is correlational evidence that abstract processing of an analogue trauma after the event is associated with prolonged negative mood and development of intrusive memories. However, no effect of post-trauma processing mode has been found on the future development of intrusive memories. To date, studies have not explored the effect of abstract or concrete processing *during* a traumatic event (i.e. peri-traumatic processing) on PTSD symptoms. It is unclear

whether processing a trauma in an abstract and overgeneralised way leads to more intrusions and other PTSD symptoms compared with adopting a concrete and contextualised processing mode during trauma.

1.7 Summary of literature review and rationale

PTSD is a debilitating condition associated with numerous adverse psychological and social outcomes. Its lifetime rate of prevalence is approximately 8% (Kessler *et al.*, 1995) although rates of sub-threshold symptoms with associated functional impairment may be even higher (Stein *et al.*, 1997). Further, certain groups such as emergency and military personnel who are routinely exposed to traumatic events may be at increased risk. The hallmark of PTSD is distressing intrusive memories, which are vivid, image-based sensory fragments of the trauma that intrude into consciousness accompanied by strong emotions, creating a sense that the trauma is happening all over again.

Cognitive models of PTSD (e.g. Brewin *et al.*, 1996; Ehlers & Clark, 2000) hypothesise that intrusive memories result from dysfunctional peri-traumatic information processing characterised by a lack of verbal-conceptual processing in favour of sensory-perceptual processing, which prevents the elaboration and contextualisation of the trauma memory. According to Ehlers and Clark (2000), intrusive memories and physiological arousal create a sense of ongoing threat, which is reinforced by dysfunctional appraisals of the trauma and its sequelae and maladaptive coping strategies. Established psychological treatments of PTSD are thought to work through elaboration of the trauma memory and modification of problematic appraisals (Ehlers & Clark, 2000), which reduce the frequency of intrusive memories and linked distress. Whilst the effectiveness of such treatments for PTSD is well-established (NICE, 2005), early interventions aimed at reducing vulnerability to or preventing PTSD in at-risk groups are lacking.

Numerous studies have indicated a vast number of factors (historical, peri-traumatic and post-traumatic) associated with increased risk of PTSD. Experimental studies using the trauma film paradigm support predictions of cognitive models, providing evidence for the causal role of peri-traumatic and post-traumatic processes in the development of PTSD. Studies using CBM methodologies have also shown that individuals can be trained (implicitly or explicitly) to

appraise trauma-related information in a more functional way which reduces emotional reactivity and intrusive memories.

Evidence is now emerging that, in addition to content, the mode of processing adopted whilst thinking about negative events is involved in the development and maintenance of emotional disorders. Studies of depression show that an abstract-evaluative mode of processing (e.g. focusing on 'Why', 'What if', on meanings and implications) is associated with increased negative mood and intrusive memories following a failure task compared with a concrete mode of processing (e.g. focusing on how events are happening and the specific details). This effect appears to be moderated by trait variables such as tendency to ruminate.

Processing mode theory has been applied to PTSD, which is also characterised by overgeneralised appraisals and a ruminative style of thinking. Ehring (2009) proposed that the dysfunctional effects of trauma-related rumination could be accounted for by reduced concreteness of processing, preventing the elaboration and contextualisation of the trauma memory. However, although correlational evidence suggests that an abstract mode of processing after an analogue trauma is associated with a greater number of intrusive memories, experimental evidence that processing mode is causally involved in the development of PTSD symptoms is currently lacking.

The effect of abstract versus concrete processing *during* a traumatic event has yet to be investigated. Studies have shown that peri-traumatic processes are important in determining the psychological sequelae of traumatic events such as intrusive memories. Holmes *et al.* (2004) argued that peri-traumatic cognitive processes are important as they affect the representations formed of the event. Using a CBM paradigm, Schartau *et al.* (2009) found that training individuals to apply functional appraisals to traumatic film clips reduced emotional reactivity to a subsequent clip. However, these appraisals were content-based and they did not look at the impact on the development of intrusive memories in relation to the clips. It is unclear whether processing analogue trauma in an abstract way leads to more intrusions and other PTSD symptoms compared with concrete processing. Abstract peri-traumatic processing would be expected to prevent processing of contextual details, inhibiting the elaboration of the trauma memory and generating overgeneral negative appraisals thereby lead to greater frequency of intrusions compared to a concrete mode of processing. Investigating the effect of processing mode during analogue trauma has implications for cognitive models of PTSD and potentially

future interventions aimed at preventing the development of distressing intrusive memories in at-risk groups.

1.8 Aims of the current study

1. To investigate the effect of peri-traumatic processing mode (abstract versus concrete) using cognitive bias modification within a trauma film paradigm on:
    - emotional reactivity to an analogue trauma (trauma film);
    - the development of intrusive memories;
    - the development of associated PTSD symptoms during the following week.

2. To explore whether individual characteristics and traits previously shown to be associated with PTSD symptoms influence the development of PTSD symptoms in this study.

1.9 Research hypotheses

1.9.1 Main hypotheses

1. Healthy participants who are trained to process traumatic films in a concrete way will experience fewer intrusive memories and associated PTSD symptoms during the following week compared with participants who are trained to process the same event in an abstract way.
2. Participants who undergo concreteness training will experience reduced emotional reactivity (distress, horror, arousal and negative affect) to the traumatic films compared with participants who are trained to process the films in an abstract way.

1.9.2 Exploratory hypotheses

1. Pre-existing individual characteristics that have been previously linked to PTSD (trait rumination, trait dissociation, proneness to intrusive memories and pre-trauma sleep difficulties) will predict the development of intrusive memories.
2. Participants who undergo abstract training will experience a greater decrease in mood over training compared with the concrete group.

2. Method

2.1 Design

A between-subjects design was used, whereby healthy participants were randomly allocated to one of two groups: training in abstract or concrete processing. They then watched a 'baseline' traumatic film clip, underwent their training, and then watched a 'test' traumatic film clip in the way they had been trained. That is, in an abstract or concrete mode. Questionnaires were administered prior to the baseline film clip, immediately after the test film clips and one week later. The independent variable was training condition, with two levels (abstract versus concrete). There were three dependent variables, which were: 1) Number of spontaneously occurring intrusive memories experienced over the week following the traumatic film viewing; 2) Severity of post-traumatic symptomatology one week after viewing, as measured by the Impact of Events Scale-Revised (IES-R; Weiss & Marmar, 1997); and 3) Emotional reactivity (negative emotion, distress, horror and arousal) to the test film following training. A pilot study was conducted to assess the acceptability of the experimental task.

2.2 Participants

Fifty-one participants took part in total. There were 29 (56.9%) females and 22 (43.1%) males. Participants ranged in age from 18-52 years with a mean age of 25.8 (SD = 7.6). Participants were staff and students from King's College London who responded to a circular email advertising the study. Exclusion criteria were a current self-reported mental health problem or scoring above cut-off on standard measures of depression and post-traumatic stress. Depression was assessed using the Personal Health Questionnaire (PHQ-9; Kroenke *et al.*, 2001) using a cut off of 10 or above (indicating major depression). Post-traumatic stress symptoms were assessed using the IES-R using a cut off of greater than 33 (recommended by Creamer *et al.*, 2003). In order to establish an index traumatic event for completing the IES-R, participants completed the trauma screener (unpublished).

2.3 Ethical issues

As the study involved watching films that contained traumatic material intended to induce PTSD symptoms (e.g. intrusive memories), there was a risk that participants would become distressed. This risk was minimised in several ways. First, participants were informed that they would be required to watch films of a traumatic nature and of the associated risks in the participant information sheet before taking part, and were given time to think about it before consenting. Second, they were informed both verbally and in writing before commencing the study of their right to withdraw at any time. Third, participants with a current self-reported mental health problem that scored above cut-off on measures of depression or PTSD were excluded, as this may have increased the risk of emotional distress in response to the trauma films. Fourth, they were informed that should they become distressed, they would be able to talk to the researcher (a clinical psychologist in training), the researcher's supervisor (a consultant clinical psychologist) or signposted to other sources of support where appropriate.

2.3.1 Ethical approval

Ethical approval was granted by the Psychiatry, Nursing and Midwifery Research Ethics Committee at Kings College London (see Appendix 1).

2.4 Power analysis and sample size

In order to conduct a power analysis, means and standard deviations of the target population are required. As these are only available on completion of the study, the means and standard deviations of prior research are used to calculate the likely effect size. The resulting value can be divided into small, medium and large. Setting power at 80% (the proposed convention for general use), one can then consult Cohen (1992) to determine the sample size, which corresponds to the effect size.

The power analysis was conducted based on the effect sizes of a similar study conducted by Schartau *et al.* (2009), investigating the effect of cognitive bias modification on emotional

reactivity to distressing films, with a between-groups design comparing an 'appraise' and a 'watch' group. Results of the power analysis showed that a sample size of 25 in each group would have 80% power to detect a significant difference in mean change scores between groups 1 and 2 using a two group t-test with a .05 two-sided significance level. It was concluded therefore that 50 participants would be needed in total.

2.5 Materials and measures

Where possible, published measures were used with established reliability and validity. However, for variables for which no existing measure had been validated, it was necessary to use or develop unpublished measures. All unpublished measures can be found in the Appendices.

2.5.1 Demographic information

General Information Questionnaire (GIQ; unpublished)

A 10-item General information questionnaire was used to obtain demographic information (Appendix 2). It elicited information on age, sex, ethnicity, native language, marital status, employment, education, and income. An additional question was included asking how frequently the participant drove a car. This was to ensure equivalence in the frequency of driving between groups since five of the eight film clips contained footage of RTAs.

2.5.2 Anxiety

State Trait Anxiety Inventory – Trait version (STAI-T; Spielberger et al., 1983)

The STAI-T is a self-report measure of anxiety proneness or 'differences between people in the tendency to perceive stressful situations as dangerous or threatening and to response to such situations with elevations of their state anxiety' (Spielberger *et al.*, 1983). It has been used

extensively in research and clinical practice with a variety of clinical and non-clinical populations and was included in the present study to ensure equivalence of groups in trait anxiety. The scale contains twenty statements about how people generally feel (e.g. 'I feel calm', 'I get in a state of tension or turmoil') for which participants are required to give frequency ratings from 1 (almost never) to 4 (almost always). Scores range from a minimum of 20 and a maximum of 80, with higher scores indicating a higher level of trait anxiety. Norms for the scale are available for working adults, college students, high school students and military recruits. It has reasonably high test-retest reliability ranging from r = .65 to r = .86 for high school students.

2.5.3 Depression

Personal Health Questionnaire – nine item (PHQ-9; Kroenke et al., 2001)

The PHQ-9 is a widely used, brief diagnostic and severity measure of depression, containing nine items which reflect DSM-IV criteria. It was included to ensure equivalence of depressive symptoms and as screening measure, where participants were excluded from the study if they score above 10. Participants indicate how often they have experienced each symptom in last 7 days (e.g. 'Feeling down depressed or hopeless', 'Having little energy'), with responses ranging from 0 (not at all) to 4 (nearly every day). Scores range from 0 to 27 with higher scores indicating a greater severity of depressive symptoms. The PHQ-9 has been validated in clinical populations (in primary care and obstetrics-gynaecology settings). It has demonstrated excellent internal consistency (Cronbach's α = .86 - .89) and excellent test-retest reliabiity (r_{tt} = .84). It has also demonstrated criterion validity, correlating with a mental health professional interview and demonstrating 88% sensitivity and 88% specificity of a score of 10 or greater for detecting major depression. Construct validity has been established, correlating strongly with functional status, disability days and symptom-related difficulties.

2.5.4 Prior trauma exposure

Trauma screener (unpublished)

The Trauma Screener (Appendix 3) is a self-report inventory of prior exposure to traumatic events which has been used in previous studies (e.g. Ehlers *et al.*, 1998). It was derived from the trauma checklist included in the Clinical Administered Post-traumatic Scale (Blake *et al.*, 1990), with additional items added assessing whether re-experiencing symptoms (intrusive memories or thoughts) were developed in relation to the trauma. This measure was included to ensure equivalence of groups in prior trauma exposure and to establish and index event on which to base the baseline IES-R. It contains a 17-item checklist of traumatic events including: serious traffic accidents; serious other accidents (e.g. fire or explosion); natural disasters; non-sexual assault; seriously injuring or killing somebody else; sexual assault, military combat or war zone; terrorist attacks; childhood sexual abuse; imprisonment; torture; life-threatening illness; witnessing others die/being seriously hurt; sudden traumatic death of significant other; life-threatening illness of significant other; and 'other traumatic events' which participants are asked to specify.

2.5.5 Post-traumatic stress symptoms

Impact of Events Scale-Revised (IES-R; Weiss & Marmar, 1996)

The IES-R was used to assess level of post-traumatic stress symptoms both prior to taking part in the study and at one week follow-up. The follow-up was completed as an online questionnaire. The IES-R is a 15-item self-report measure of post-traumatic stress symptoms, which is a widely used in both clinical and research settings. The original Impact of Events Scale (IES) was developed by Horowitz (1979) to assess subjective distress following a stressful life event. It comprised two subscales of intrusion (thoughts, feelings, nightmares, images, dissociative like re-experiencing, e.g. 'I thought about it when I didn't mean to', 'pictures about it popped into my mind') and avoidance (numbing of responsiveness, avoidance of feelings, situations and ideas, e.g. 'I tried not to think about it'). Subjects are required to indicate frequency of these symptoms over the past week in relation to an index event.

Weiss and Marmar (1997) revised the IES to include a third subscale capturing to the third core DSM-IV symptom cluster of hyperarousal (anger, irritability, hypervigilance, difficult concentrating, heightened startle; APA, 1994; e.g. 'I felt watchful and on guard'), so that the revised scale contains 22 items. They also altered the response scale so that subjects indicate to what extent they have been distressed by the symptoms listed from 0 (not at all) to 4 (extremely). The scale yields a total score of 88, with higher scores indicating greater severity of PTSD symptoms. The revised scale has been validated with both non-clinical and clinical samples (Weiss & Marmar, 1997; Creamer *et al.*, 2003). It has demonstrated high internal consistency for the total scale (α = .96), and adequate to high internal consistencies for the three subscales (α = .87-.94 for the intrusion scale, α = .84-.87 for the avoidance scale and α = .79-.91 for the hyperarousal scale). Test-retest reliability coefficients ranged from r = .5-.9 for the total scale; r = .57-.94 for the intrusion scale; r = .51-.89 for the avoidance scale and r = .59-.92 for the hyperarousal scale. Concurrent validity has been documented with the scale being highly correlated (r = .84) with the Post-traumatic Checklist, an established measure of PTSD symptoms. Creamer *et al.* (2003) found that a clinical cut off of 33 on the IES-R provided the best diagnostic accuracy for PTSD.

2.5.6 Trait rumination

Perseverative thinking questionnaire (PTQ; Ehring et al., 2010)

The PTQ is a content-independent self-report measure of repetitive negative thinking (RNT) such as rumination and worry, which was developed with the rationale that existing measures of RNT were highly content-dependent (e.g. relating specifically to depression or anxiety). It was used to assess trait rumination and the potential relationship of this with intrusive memories. The PTQ contains 15 items, with three subscales assessing different aspects of RNT. The first subscale relates to the core characteristics of repetitiveness (e.g. 'the same thoughts keep going through my mind again and again'), intrusiveness (e.g. 'thoughts come into my mind without me wanting them') and difficulties with disengagement (e.g. 'I can't stop dwelling on them'). The second subscale relates to the unproductiveness of RNT (e.g. 'I keep asking myself questions without finding an answer') and the third to RNT capturing mental capacity (e.g. 'my thoughts prevent me focusing on other things'). Subjects are required to rate the frequency of each item, ranging from 0 (never) to 4 (always). The maximum score is 60, with higher scores indicating a greater tendency towards repetitive negative thinking (e.g. rumination and worry).

The scale has been validated on non-clinical and clinical samples, in both English and German. Excellent internal consistency have been reported for the total scale (α = 0.94-0.95) and internal consistencies for the three subscales range from acceptable to high (core characteristics α = 0.92-.94, unproductiveness α = 0.77-.87, capturing mental capacity α = 0.82-.90). Satisfactory test-retest reliability has been reported for the whole scale (r_{tt} = 0.69) and for the three subscales (r_{tt} = .66, r_{tt} = .68 and r_{tt} = .69 respectively). The measure has demonstrated convergent validity, correlating significantly with standard content-dependent measures of rumination and worry (the rumination scale of the Response Style Questionnaire, Nolen-Hoeksema & Morrow, 1991; the Penn State Worry Questionnaire, Meyer *et al.*, 1990; and the Rumination Scale; McIntosh, 1995). It also shows predictive validity, with significant and substantial correlations found with severity of anxiety and depressive symptoms and with individuals with anxiety and depression scoring significantly higher than those without (Ehring *et al.*, 2010).

2.5.7 Proneness to intrusive memories

Proneness to intrusive memories scales (unpublished)

A self-report measure of proneness to intrusive memories was developed for this study (Appendix 4), similar to that used by Davies and Clark (1998b). It was administered to assess participants' proneness to negative and positive intrusions and the potential relationship between these and the subsequent development of intrusive memories after exposure to the analogue trauma. It consisted of three 5-point Likert scales assessing trait tendency towards different intrusive memory experiences; including intrusive memories of a stressful or unpleasant event, seeing an unpleasant event on television and a positive or happy event. Subjects rated the frequency with which they experienced these over a week on a scale ranging from 0 (not at all) to 5 (5 times a week or more).

2.5.8 Sleep problems

Insomnia severity index (ISI; Morin et al., 1993)

The ISI is a brief 7-item screening measure for insomnia severity over the past two weeks. It was used to assess the relationship between pre-existing sleep difficulties and the subsequent development of intrusive memories in response to the film. It looks at subjective symptoms and impact of insomnia, as well as level of related concern or distress. It contains seven items which correspond in part to the diagnostic criteria for insomnia, including: (a) sleep onset, sleep maintenance and early awakening; (b) satisfaction with current sleep pattern; (c) interference with daily functioning; (d) noticeability of impairment; and (e) level of distress caused by the sleep problem. Each item is rated on a 5-point Likert scale ranging from 0 (not at all) to 4 (extremely). The total score ranges from 0 to 28 with higher scores indicating higher severity of insomnia. The measure has been validated on younger and older populations attending a sleep clinic or receiving treatment for insomnia, and has demonstrated adequate internal consistency (α = 0.74-0.78). It has also demonstrated concurrent validity, correlating significantly with other measures of insomnia (sleep diaries, polysomnography, informant and clinician reports) and sensitivity in detecting change in perceived sleep difficulties following treatment (Bastien *et al.*, 2001).

2.5.9 Trait dissociation

Trait dissociation questionnaire – short version (TDQs; Murray, 1997)

The TDQs is an 11-item valid and reliable measure of trait disposition to dissociation. It was administered to assess participants' level of trait dissociation and the relationship of this to the number of intrusive memories developed. The TDQs measures seven aspects of dissociation, including detachment from others and the world; sense of split self; lability of mood and impulsivity; inattention and memory lapses; emotional numbing; confusion and altered sense of time; and amnesia for important life events, which were supported by factor analysis. Subjects are required to report the frequency with which they experience these aspects of dissociation from 0 (never) to 5 (always). It was developed from a larger 38-item version with high internal

consistency (α = 0.93) and good test-retest reliability (*r* = 0.86), which predicted intrusive memories in a student population (Murray, 1997). The shorter version was validated with an outpatient sample and correlated highly with the original TDQ (*r* = 0.94). It showed good internal consistency (α = 0.86) and adequate retest reliability (*r* = 0.56).

2.5.10 Intrusive memories

Intrusions diary (unpublished)

Number of intrusive memories developed in the week following the analogue trauma was assessed using an intrusions diary (Appendix 5), which participants completed for one week after the film task. This is a standard way of assessing frequency of intrusions and has been extensively used in analogue trauma paradigms (see Holmes & Bourne, 2008). It comprised a sheet of paper with a table divided up by the days of the week. Each day contained a column for recording the total number of intrusions, whether the intrusions were thoughts or images and which film clips they referred to.

2.5.11 Emotional reactivity

Emotional reactivity scales (unpublished)

Emotional reactivity to the test films was assessed using four 11-point Likert scales ranging from 0 to 10 (Appendix 6). These measured valence of emotion (ranging from extremely negative to extremely positive), distress (ranging from no distress to extreme distress), horror (ranging from no horror to extreme horror) and arousal (ranging from no arousal to extreme arousal).

Distress and horror were chosen as they were the target emotions used by Schartau *et al.* (2009), who demonstrated an effect of appraisal training on these emotions in reaction to distressing films. Schartau and colleagues focused on these emotions since they were most intensively evoked during piloting of their distressing film clips. They also noted that generalised emotion

terms (e.g. distress, negative emotion) have been demonstrated as reliable indices of emotion change in response to experimental manipulations (Richards & Gross, 2000) and bear similarity to the Subjective Units of Distress measure which is often used in clinical research and practice (e.g. Dalgleish & Yiend, 2006). They further noted that distress and horror are emotions historically elicited by traumatic experiences.

Subjective level of arousal was also included as an emotional reactivity measure in this study to explore the impact of training on this variable between conditions, given that higher post-trauma arousal has been linked to the subsequent development of PTSD (O'Donnell *et al.* 2007). Valence of affect was used to explore whether greater levels of overall negative affect elicited by the film was associated with more intrusions.

2.5.12 Personal relevance and mood ratings

Personal relevance scale (unpublished)

An 11-point Likert scale was used to assess the personal relevance of the pre- and post-training films (Appendix 7). This was included in order to investigate potential differences between the groups in the extent to which they found the post-training test film clip more personally relevant compared with the baseline clip, since the abstract group's instructions encouraged them to relate the films to their own lives. Participants were asked 'How much personal relevance did this film have for you?' with the scale ranging from 0 (none) to 100 (extreme).

Mood rating (unpublished)

An 11-point Likert scale was used to assess participants' self-reported mood before and after training (Appendix 8). The scale ranged from 0 (extremely negative) to 100 (extremely positive).

2.5.13 Manipulation and diary compliance checks

Manipulation check for processing mode (unpublished)

Participants' self-report compliance to the allocated processing mode (Appendix 9) was indexed using an 11-point Likert scale which asked 'To what extent did you watch the film according to the instructions given to you?', with responses ranging from 0 (none of the time) to 100 (all of the time). In addition, their level of attention to the film was assessed by asking 'To what extent did you pay attention to the film?' with an 11-point Likert scale of responses ranging from 0 (none of the time) to 100 (all of the time). Participants were excluded if their level of adherence was less than 50% of the time.

Diary compliance (unpublished)

Diary compliance (the extent to which participants completed the diary reliably and accurately) was assessed using an 11-point Likert scale with responses ranging from 0 (never) to 100 (all of the time; Appendix 10). This measure was also completed online, following the IES-R.

2.5.14 Trauma films

The two test films (shown pre- and post-training) contained real-life footage of the aftermath of RTAs and included scenes of destruction, severely injured people in distress and dead bodies. These two clips, along with three of the training films with similar content, have been used in previous studies (e.g. Steil, 1997). The remaining three training clips included scenes of violence involving animals and humans, which were borrowed with permission from Schartau *et al.* (2009). Each film (including the two test films) contained a short voice-over at the beginning explaining what the clip was about. Film clips ranged from 21 to 137 seconds with a mean length of 89 seconds (SD = 35.88). Since the films involved witnessing events that involved 'actual or threatened death or serious physical injury', which elicited significant levels of distress and horror (see Section 2.6 below), the film content conformed to the DSM-IV criteria for a traumatic event (APA, 1994).

2.6 Pilot phase

There were two pilot phases. The first was to select the two test films and the second was to assess the acceptability of the experimental task. All pilot participants met inclusion criteria for the study and gave written informed consent. The two test films were chosen from a series of seven clips used by Steil (1997). A pilot study was conducted with student volunteers (N = 10) at King's College London to determine which two test films evoked the most distress out of the set of seven films and hence may best used as a baseline film before training and a test film after training in the study (see Table 1). The mean age of the pilot sample was 31.7 years (SD = 10.1, range = 25-58). Three (30%) were male and seven (70%) were female. The mean distress rating of the baseline film (film 6) was 55.3 (SD = 27.8). The mean distress rating of the post-training test film (film 3) was 59.7 (SD = 23.5). These two films were comparable in the level of distress they evoked, $t(9) = 1.346$, $p = .211$.

Film	Distress Mean (SD)	Horror Mean (SD)	Arousal Mean (SD)	Valence Mean (SD)
1	47 (29.7)	49.6 (34.7)	43.3 (28.1)	24.9 (13.8)
2	42 (30.4)	44 (30.5)	50 (30.2)	37.4 (15.2)
3	59.7 (23.5)	62.5 (23.5)	60.4 (30.3)	20.6 (9.4)
4	43.5 (31.9)	42.6 (36.1)	46.3 (30.0)	25 (13.3)
5	47.3 (24.2)	57.3 (29.1)	57 (33.4)	20 (13.9)
6	55.3 (27.8)	58 (30.8)	53.9 (39.4)	20.8 (10.4)
7	38.8 (28.6)	34.8 (29.6)	35.3 (29.7)	28.9 (13.4)

Table 1. Means and standard deviations (SD) of emotional reactivity ratings of RTA film clips.

A second pilot study was conducted to establish feasibility and acceptability of the experimental procedure. This used the present version of the current study. Participants were volunteers from the MindSearch database who met the study inclusion criteria. One participant was excluded from the analysis for failing the manipulation check relating to adherence to instructions. The whole sample had a mean age of 33.3 years (SD = 11.0, range 23-60). The mean age for the abstract group was 32.3 years (SD = 11.16) and 34.3 years (SD = 11.61) for the concrete group, with no significant difference in age between the two groups, $t(13) = -.333$, $p = .745$. Of the sample, 6 participants were male (37.5%) and 10 were female (62.5%), and groups were equivalent in sex, $\chi^2(1) = .001$, $p = 1.000$. Table 2 compares baseline measures and manipulation checks for both groups, showing that there were no significant differences between groups (p = > .1).

Variables	Abstract (N=8) Mean (SD)	Concrete (N=8) Mean (SD)	t-tests
PHQ	2.14 (2.12)	1.13 (1.36)	$t(13) = 1.125$, $p = .281$
STAI-T	35.00 (7.44)	30.38 (7.11)	$t(13) = 1.230$, $p = .240$
Trauma checklist	2.29 (1.98)	1.88 (2.10)	$t(13) = .388$, $p = .704$
IES-R (baseline)	8.43 (7.91)	3.88 (5.17)	$t(10.1) = 1.299$, $p = .223$
PTQ	32.00 (11.45)	19.71 (15.91)	$t(12) = 1.658$, $p = .123$
TDQ-s	7.29 (6.13)	5.14 (4.26)	$t(13) = .542$, $p = .597$
ISI	4.00 (3.10)	4.86 (2.85)	$t(11) = -.519$, $p = .614$
Proneness to intrusions 1	0.83 (0.75)	1.00 (0.58)	$t(11) = -.452$, $p = .660$
Proneness to intrusions 2	0.50 (0.55)	0.43 (0.54)	$t(11) = .238$, $p = .817$
Proneness to intrusions 3	2.33 (0.82)	2.00 (0.58)	$t(11) = .860$, $p = .408$
Test film 1 distress	50.00 (26.46)	41.25 (33.57)	$t(13) = .554$, $p = .589$
Test film 1 horror	52.86 (32.0)	37.50 (34.54)	$t(13) = .889$, $p = .390$
Test film 1 arousal	35.71 (13.97)	20.00 (25.07)	$t(13) = 1.275$, $p = .225$
Test film 1 valence	35.71 (22.25)	33.13 (10.99)	$t(13) = .402$, $p = .695$
Mood post-training	44.29 (17.18)	56.88 (25.21)	$t(13) = -1.112$, $p = .286$
Attention to final film	95.00 (5.35)	90.00 (11.55)	$t(13) = -1.102$, $p = .291$
Mode compliance	75.71 (22.25)	85.00 (15.12)	$t(13) = -.957$, $p = .356$

Table 2. Means, standard deviations and t-tests of baseline measures and manipulation checks by group for the pilot sample.

Table 3 compares emotional reactivity ratings in response to the two test films between groups. It shows that the groups were equivalent in levels of emotional reactivity to the baseline test film clip. However, after training, the abstract group showed significantly greater distress, horror, arousal and negative affect in response to the second test film clip.

	Abstract	Concrete	t-tests
Test film 1 distress	50 (26.46)	41.25 (33.57)	$t(13) = .554$, $p = .589$
Test film 1 horror	52.86 (32.0)	37.5 (34.54)	$t(13) = .889$, $p = .390$
Test film 1 arousal	35.71 (13.97)	20.0 (25.07)	$t(13) = 1.275$, $p = .225$
Test film 1 valence	35.71 (22.25)	33.13 (10.99)	$t(13) = .402$, $p = .695$
Test film 2 distress	77.14 (26.28)	45.00 (27.26)	$t(13) = 2.317$, $p = .037$
Test film 2 horror	68.57 (25.45)	32.50 (27.12)	$t(13) = 2.644$, $p = .020$
Test film 2 arousal	75.71 (19.88)	25.00 (28.79)	$t(13) = 3.908$, $p = .002$
Test film 2 valence	12.86 (16.04)	42.50 (25.36)	$t(13) = -2.657$, $p = .020$

Table 3. Means, standard deviations and t-tests of emotional reactivity scores by group for pilot sample.

Table 4 compares number of intrusive memories and IES-R scores between groups. The mean number of intrusions and IES-R scores was higher in the abstract compared with the concrete group although the difference was not statistically significant.

	Abstract	Concrete	t-tests
Intrusions	4.14 (3.63)	2.13 (2.42)	$t(13) = 1.285$, $p = .221$
IES-R	9.29 (8.10)	3.63 (4.24)	$t(8.8) = 1.661$, $p = .132$

Table 4. Means, standard deviations and t-tests of intrusions and IES-R scores by group for pilot sample.

2.7 Procedure

An overview of the study procedure is illustrated in Figure 2. An email circular advertising the study was circulated to all staff and students at King's College London (Appendix 11). Participants were given the rationale that the study was looking at what factors influence people's reactions to trauma. Those who responded to the email expressing interest in taking part and were sent a detailed information sheet to read and consider (Appendix 12). Prior to deciding whether they wanted to take part, they were given the opportunity to ask any questions. Those who still wanted to take part on reading and considering the information sheet were invited to attend a session of approximately one hour, which took place in a quiet testing room at the Institute of Psychiatry. All participants were reminded verbally at the outset of the session that they were free to withdraw at any time and without giving a reason. Written consent was obtained for all participants (Appendix 13), followed by screening measures (PHQ, trauma screener and IES-R). Those who did not meet the inclusion criteria based on these questionnaires were informed of this and signposted to potential sources of support. A risk assessment and management plan was put in place for those who expressed suicidal ideation. Those who met the inclusion criteria were asked to complete a series of baseline measures (STAI-T, GIQ, PTQ, proneness to intrusions, TDQ-s, ISI and mood rating). Participants were then randomly allocated to either the abstract or concrete training condition to complete the film task. Following the film task, participants were given an intrusion diary to take with them and to record for one week. One week after the task, they were asked to post back the diaries (in a stamped addressed envelope provided) and complete the online IES-R.

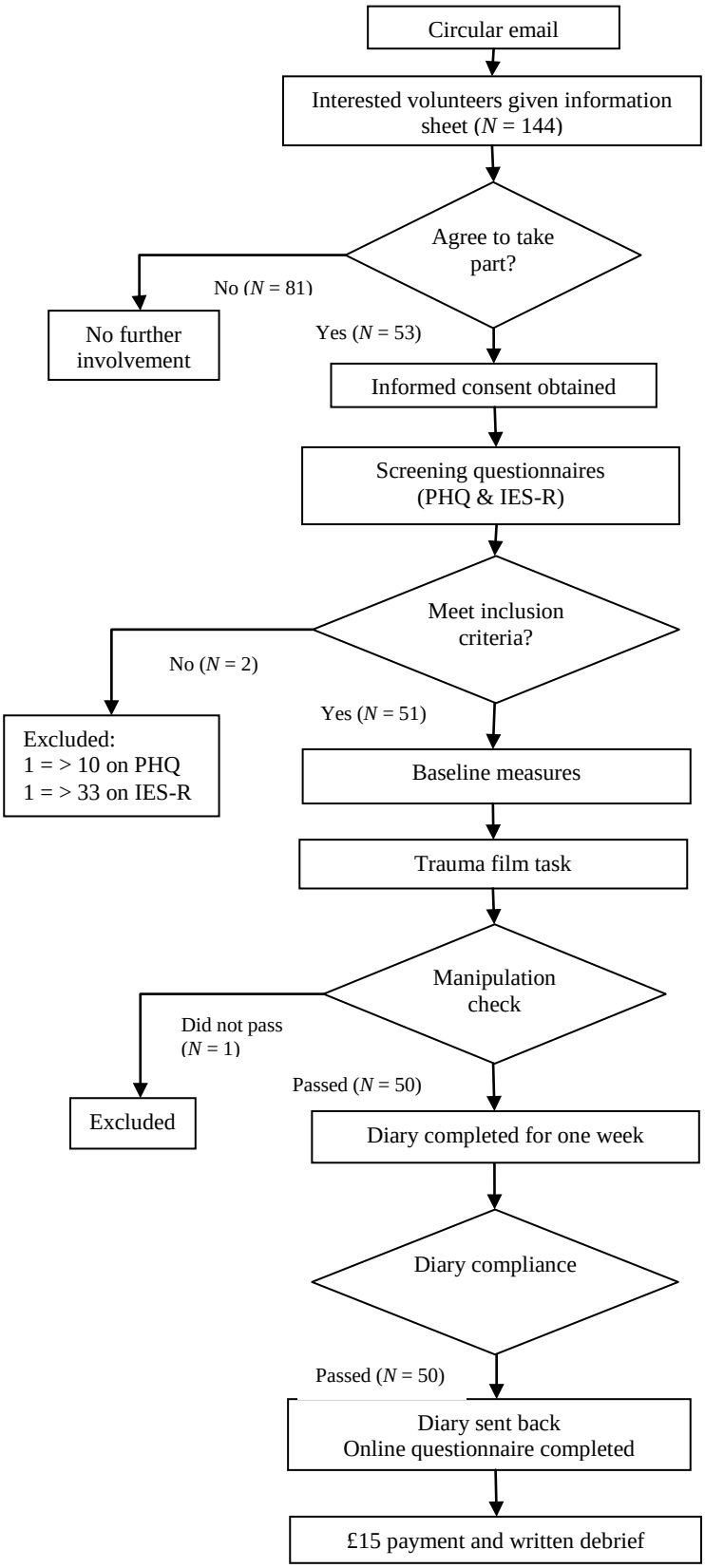

Figure 2. Overview of study procedure.

2.7.1 Film task

The film task procedure is summarised in Figure 3. Participants sat in a comfortable chair and watched the films at a desk on a 15 inch laptop screen. They were told that the task involved watching a series of film clips of real-life traumatic footage, which they would be asked to watch in a particular way according to some instructions they would be given. For the baseline test film, participants were asked to simply watch the film as they would normally and completed the measures of emotional reactivity and personal relevance afterwards. Following the first test film, participants were given instructions for how to watch the subsequent clips according to the condition they had been assigned to.

In the abstract condition, participants were given the following instructions:

'For each film, I would like you to focus on:

1.) Why these sorts of things happen;

2.) What it means about the world;

3.) What it means for the people involved;

4.) What if this was to happen to you, or someone in your family?'

In the concrete condition, participants were given the following instructions:

'For each film, I would like you to focus on:

1.) The specific and objective details of the event, for example, what you can see, what you can hear;

2.) The sequence of events as they are unfolding;

3.) What needs to happen step by step from here.'

All participants were informed that it was not a memory test and that they would get a chance to practise and familiarise themselves with the instructions. They were given the opportunity to ask questions for clarification and further explanation was given if necessary.

In order to help them understand how to process in an abstract or concrete way, participants were told what the first training film depicted and given examples of how someone adopting the particular processing mode might view this film. For the abstract condition, participants were told: 'Here is the first film. It is about an elderly man whose wife is killed by a drunk driver, and the man ends up having a breakdown and taking his own life on the motorway. In relation to why these things happen, you might think that they happen because of other people's carelessness or for no good reason. In relation to what it means about the world, you might think that it means the world can be unfair and unpredictable. In terms of the implications you might wonder about the effect on the man's family and on the police that witnessed it. Finally, you may consider what if this was to happen to you or someone in your family.'

For the concrete condition, participants were told: 'Here is the first film. It is about an elderly man whose wife is killed by a drunk driver, and the man ends up having a breakdown and taking his own life on the motorway. So focusing on the specific details you might notice that there is a man with a gun who is standing next to a car, and register other details such as what colour the car is, what else you can see in the scene, what time of day it is, what the police are shouting and so on. In focusing on the sequence of events you might think to yourself "the man is walking over to the boot of his car, he's opening the boot, he's loading his gun, he's looking around", and so on. In terms of what is needed to happen step by step from here, you may simply think that the road needs to be closed off and there needs to be an investigation.' Again, participants were given the opportunity to ask questions before presentation of the first film clip.

Following the first three training films, participants were asked to give examples of what they were thinking about or focusing on whilst watching the film so that the investigator could be sure that they understood the instructions and were adopting the mode of processing correctly. Where participants demonstrated difficulty applying the required mode of processing or their feedback reflected thoughts that were inconsistent with that mode of processing, further instruction was given. For the last three training clips, participants were simply asked whether they thought they had successfully applied the required mode of processing.

Before each training film, written prompts containing the processing mode instructions appeared on the computer screen. After each training film the word 'relax' appeared on the screen for five seconds, which aimed to minimise any accumulative effect of the training phase on mood.

A second mood rating was obtained after the training phase, prior to the final test film. Participants were told that this was the last film and were reminded to pay attention to it whilst adopting the required mode of processing. Following the final test film, participants completed the emotional reactivity, personal relevance and manipulation check measures.

At the end of the testing session, participants were given the intrusions diary with instructions for completing it. They were asked to carry it with them for the next week and to record any spontaneously occurring memories that they experienced relating to any of the film clips. They were given a specific timescale (from leaving the test room to the same time the following week) and the specific days were written on their diary for ease of completion. To promote compliance with the diary, participants were asked whether they could foresee any difficulties with completing it, and if so, the experimenter helped the participant problem-solve how compliance with the diary could be maximised.

One week after the session, participants were sent an email prompting them to return the diary (in a stamped addressed envelope which had been given to them) with a link to the online questionnaire containing the IES-R and diary compliance measure. Once the online questionnaire had been completed and the diary was received, participants were sent a payment of £15 as compensation for their time. All participants received a written debrief on completion of their participation, after they had sent back their diary and completed the online questionnaire.

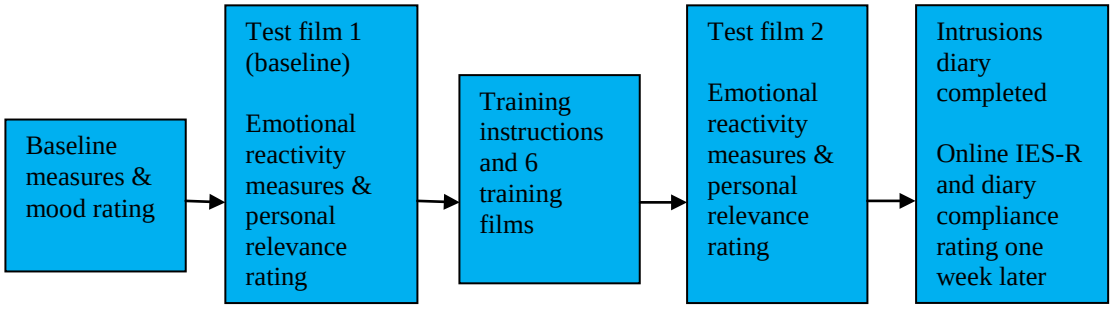

Figure 3. Overview of trauma film procedure.

2.8 Data analysis

Independent samples t-tests were conducted to investigate possible pre-experimental group differences in baseline measures, manipulation and diary compliance checks, as well as number of intrusive memories and IES-R scores one week later. Chi-squared tests were used to test for possible baseline differences categorical variables. Mixed (2 x 2) ANOVAS were conducted to compare pre- and post-training emotional reactivity (distress, horror, valence and arousal) between the two groups, as well as pre- and post-training levels of mood and personal relevance of the test film clips, with training condition (abstract versus concrete) as the between groups factor and time (pre-film versus post-film) as the repeated measures factor. Bivariate Pearson's correlations were conducted to explore relationships between individual predictor variables and outcome (number of intrusive memories and IES-R score). A hierarchical regression analysis was carried out to investigate the relationship of these variables to number of intrusive memories developed. Finally, potential interactions between these baseline vulnerability measures and training condition in predicting number of intrusions was investigated by carrying out individual hierarchical regression analyses and including the interaction terms.

3. Results

Variables were assessed for normality by obtaining values of skewness and kurtosis and calculating their associated *z*-scores, with a cut off of 2.58 following Field (2009). Those with *z*-scores of 2 and above were inspected visually using histograms and Q-Q plots. Variables that violated assumptions of normality were log 10, square root or reciprocally transformed where appropriate, and variables that could not be successfully transformed were analysed using non-parametric tests. Observed rather than transformed values are reported for purposes of readability. Homogeneity of variance was assessed with Levene's test before using parametric tests. All analyses used a two-tailed significance level of $\alpha = .05$. Data were analysed using SPSS for Windows version 18.

One participant failed the adherence check related to the experimental manipulation, reporting a complete failure to follow the instructions whilst watching the final test clip. This participant also failed the adherence check related to the intrusions diary, reporting that they had not completed it accurately or reliably. This person's data were excluded for failing to meet reliability standards.

3.1 Group comparisons at baseline

The mean age of participants was 27.2 years, in the abstract condition (SD = 9.1) and 24.7 years in the concrete condition (SD = 5.4), and a t-test showed no significant difference in age between the two conditions, $t(48) = .004$, $p = .367$. In both groups, the majority of participants were female, with 15 females (57.7%) in the abstract condition and 13 females (54.2%) in the concrete condition. A chi-squared analysis showed no significant differences in sex between the two conditions, $\chi^2(1) = .063$, $p = .802$. There were no between-group differences in frequency of driving, $\chi^2(1) = .024$, $p = .877$ with 7 (26.9%) driving at least once a week in the abstract group and 6 (25%) driving at least once a week in the concrete condition.

Table 5 compares means and standard deviations of baseline measures between the groups. There were no significant differences between the two groups in trait anxiety (STAI-T) or depression (PHQ). Both groups reported equivalent levels of prior trauma exposure on the trauma checklist and there were no significant differences between the groups in baseline symptom levels of PTSD on the IES-R. Scores on the PHQ, STAI-T and IES-R are all below clinical cut-offs.

Baseline measures	Abstract (*N* = 26) Mean (SD)	Concrete (*N* = 25) Mean (SD)	t-tests
PHQ	1.88 (2.18)	2.17 (1.20)	$t(39.6) = -.572$, $p = .570$
STAI-T	30.15 (7.15)	32.58 (7.19)	$t(48) = -1.197$, $p = .237$
Trauma checklist	1.38 (1.42)	1.33 (1.61)	$t(48) = .276$, $p = .784$
IES-R (baseline)	5.15 (6.29)	6.54 (7.83)	$t(48) = -.321$, $p = .750$

Table 5. Means, standard deviations and t-tests of baseline measures by group.

Comparisons of predictor variables between groups are presented in Table 6. There were no significant differences between the two groups in the levels of trait rumination (PTQ); trait dissociation (TDQs); self-reported proneness to intrusive memories after stressful events (PTI1), unpleasant scenes on television (PTI2) or positive events (PTI3); or sleep difficulties (ISI).

Predictor variables	Abstract (*N* = 26) Mean (SD)	Concrete (*N* = 25) Mean (SD)	t-tests
PTQ	14.54 (9.47)	16.83 (11.26)	$t(48) = -.782$, $p = .438$
TDQ-s	6.92 (5.76)	6.75 (4.23)	$t(47) = -.058$, $p = .954$
ISI	5.31 (5.42)	4.38 (2.84)	$t(43.3) = .395$, $p = .695$
PTI 1	1.31 (1.16)	1.25 (1.03)	$t(48) = .185$, $p = .854$
PTI 2	0.73 (0.60)	0.71 (0.69)	$t(48) = .123$, $p = .903$
PTI 3	2.73 (1.00)	2.29 (1.04)	$t(48) = .1.519$, $p = .135$

Table 6. Means, standard deviations and t-tests of predictor variables by group.

Table 7 compares ratings of baseline mood (prior to watching the first test clip), emotional reactions to the first test clip (distress, horror, arousal and valence) and ratings of personal relevance for the first test clip between groups. There were no significant differences in ratings of mood, distress, horror, valence or personal relevance of the first test film clip. Unexpectedly, there was a significant difference between the groups in self-reported levels of arousal in relation to the first film clip, with the abstract group giving higher subjective ratings of arousal than the concrete group. Since this was based on a subjective measure of arousal however, for

which no objective physiological data are available, it should be interpreted with caution. Furthermore, it was not significantly correlated with the hyperarousal scale of the IES-R at one week (r = .225, p = .116).

Baseline state measures	Abstract (N = 26) Mean (SD)	Concrete (N = 25) Mean (SD)	t-tests
Baseline mood rating	75.25 (16.82)	72.75 (11.72)	$t(38) = .545$, $p = .589$
Test film 1 distress	49.81 (23.34)	45.21 (25.43)	$t(48) = .667$, $p = .508$
Test film 1 horror	47.12 (24.67)	41.46 (27.72)	$t(48) = .764$, $p = .449$
Test film 1 arousal	39.81 (27.66)	25.00 (20.64)	$t(46.1) = 2.156$, $p = .036$
Test film 1 valence	30.77 (13.17)	33.33 (12.99)	$t(48) = -.692$, $p = .492$
Test film 1 personal relevance	15.00 (23.37)	14.17 (21.65)	$t(48) = -.101$, $p = .920$

Table 7. Means, standard deviations and t-tests of mood and responses to baseline test film clip by group.

Between group comparisons of manipulation check scores are shown in Table 8. All participants generally reported paying attention to the film (> 70% of the time) and complying with their allocated mode of processing (> 50% of the time).

Manipulation check	Abstract (N = 26) Mean (SD)	Concrete (N = 25) Mean (SD)	t-tests
Attention to final film	91.92 (10.87)	92.29 (11.03)	$t(48) = .021$, $p = .983$
Mode compliance	86.35 (12.46)	85.42 (7.93)	$t(48) = -1.053$, $p = .298$

Table 8. Means, standard deviations and t-tests of manipulation checks by training condition.

In addition, there were no significant differences between the two groups in terms of their self-reported compliance with the intrusion diary, U = 255, z = -.630, p = .528, with all participants reporting completing it reliably and accurately either ‘most of the time’ or ‘all of the time’.

3.1.1 Summary

Participants completed a range of baseline trait and state measures at the beginning of the testing session and after viewing the first test film clip. Between group comparisons showed

that groups did not differ on demographic variables, baseline questionnaires, state measures or ratings of distress, horror and valence in response to the first test film. However, the abstract group rated themselves as significantly more aroused in relation to the first test film clip, although the validity of this measure is unclear.

3.2 Change in mood and personal relevance of film clips

Mixed ANOVAs were conducted to assess potential change in mood and personal relevance of the test film clips over the course of the testing session. Effect sizes were derived using partial eta-squared (η^2_p), where $\eta^2_p = .01$ represents a small effect size, $\eta^2_p = .06$ a medium effect size and $\eta^2_p = .14$ a large effect size (Cohen, 1988). Figure 4 compares change in mood ratings from pre- to post-training between groups. There was a main effect of time on mood, with both groups reporting a decrease in mood from pre- to post-training, $F(1, 37) = 104.36$, $p = .001$, $\eta^2_p = .738$. There was no main effect of condition on mood $F(1, 37) = 1.054$, $p = .311$, $\eta^2_p = .028$. However, there was a significant interaction between condition and mood over time, $F(1, 37) = 5.26$, $p = .028$, $\eta^2_p = .124$ with decrease in mood in the abstract group being more pronounced in the abstract condition. Paired sampled t-tests confirmed that in both groups there was a significant decrease in mood from pre- to post-training (abstract: $t(18) = 8.221$, $p = .001$; concrete: $t(10) = 6.056$, $p = .001$). Independent samples t-tests revealed that whereas there was no significant difference in mood between groups before training, $t(38) = .545$, $p = .589$, the abstract group gave significantly lower ratings of mood after training, $t(47) = -2.688$, $p = .010$.

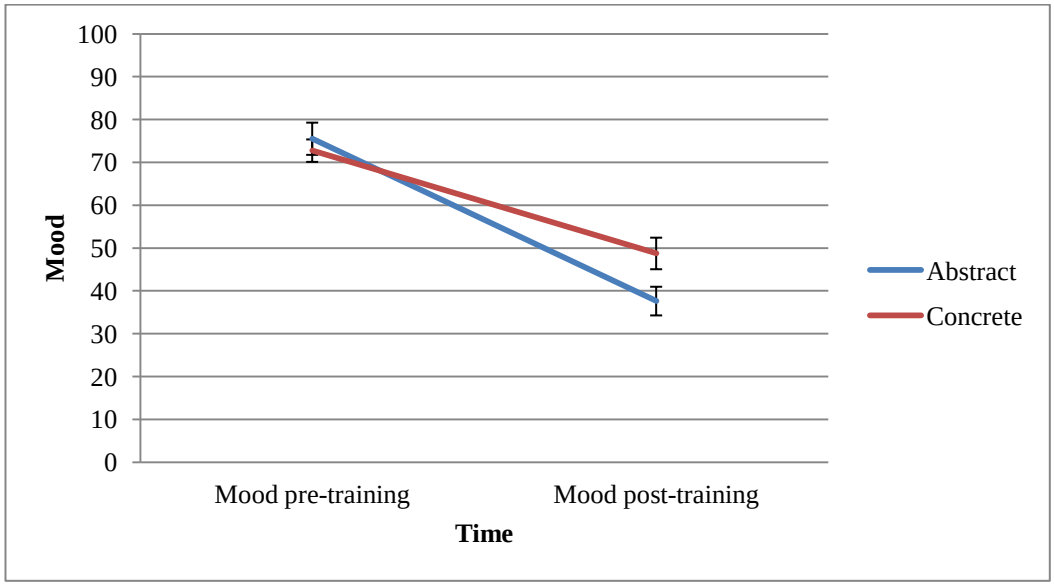

Figure 4. Change in ratings of mood from pre- to post-training between groups.

Figure 5 shows change in ratings of personal relevance of the test film clips over time for both groups. Again, there was a significant main effect of time, $F(1, 48) = 18.771$, $p = .001$, $\eta^2_p = .281$, indicating that both conditions rated the second test clip as having more personal relevance than the first. However, there was no main effect of condition on personal relevance $F(1, 48) = .259$, $p = .613$, $\eta^2_p = .005$, and no interaction between condition and change in personal relevance over time $F(1, 48) = .917$, $p = .343$, $\eta^2_p = .019$. This suggests that ratings of personal relevance between the groups were generally the same.

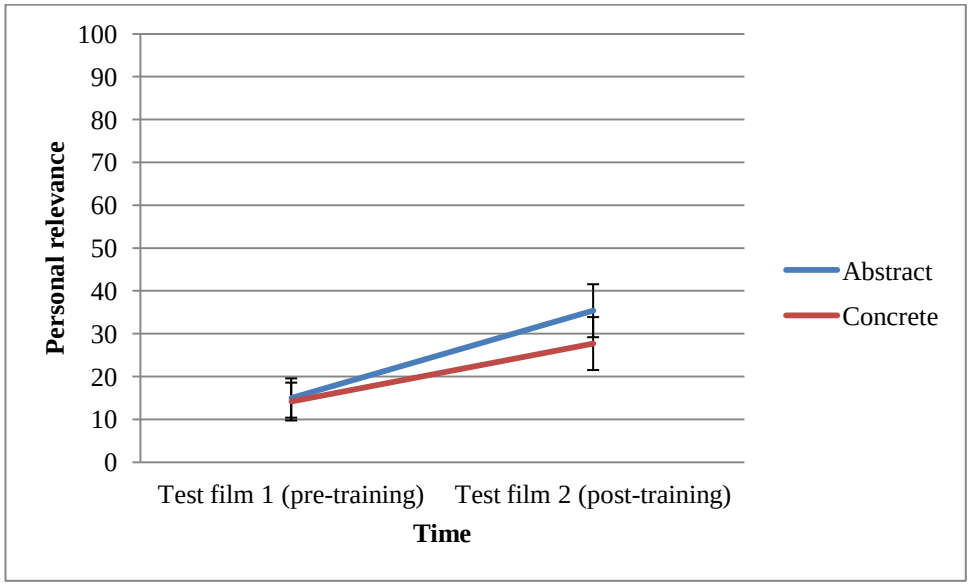

Figure 5. Change in ratings of personal relevance of pre- and post-training test film clips between groups.

3.2.1 Summary

Changes in mood state and degree to which participants experienced the test film clips as personally relevant from pre- to post-training were compared between groups. This indicated that both groups reported a decrease in mood across the testing session, although this was more marked in the abstract group. Both groups showed a comparable increase in the degree to which they found the second (post-training) test film clip more personally relevant.

3.3 Analysis of hypotheses

3.3.1 Hypothesis 1: Participants who are trained to process traumatic films in a concrete way will experience fewer intrusive memories in relation to the film clips compared with participants who are trained to process the clips in an abstract way

Independent samples t-tests were conducted to investigate differences in primary outcome measures assessed at one-week follow-up: the number of intrusive memories experienced in the week following the test-session and total and sub-scale IES-R scores. Effect sizes were calculated using Pearson's *r*, where $r = .10$ represents a small effect, $r = .30$ a medium effect and $r = .50$ a large effect (Field, 2009). Potential between group differences in the number of image- and thought-based intrusive memories were also investigated. Pearson's correlations were conducted to investigate the relationship between baseline measures, their changes over the course of the session, and outcome measures. Where baseline measures were significantly correlated with primary outcomes, they were treated as covariates in the relevant analyses.

Of the whole sample, 47 participants (94%) reported at least one intrusive memory relating to the film clips. Table 9 shows the mean number of intrusive memories and IES-R scores by group.

	Abstract condition Mean (SD)	Concrete condition Mean (SD)
Intrusive memories	11.85 (11.06)	6.29 (4.81)
IES-R total	12.62 (12.71)	6.29 (4.31)
IES-R intrusion scale	6.62 (4.07)	3.79 (2.62)
IES-R avoidance scale	4.85 (5.40)	2.29 (2.39)
IES-R hyperarousal scale	1.15 (2.26)	0.21 (0.59)

Table 9. Means and standard deviations of intrusive memories and IES-R scores by group.

Figure 6 displays the differences between the two groups for total number of intrusive memories recorded in the diary and for total IES-R scores. The concrete group reported significantly fewer intrusive memories that the abstract group, $t(48) = 2.06$, $p = .044$, $r = .29$. The concrete group also reported significantly lower IES-R scores than the abstract group, $t(48) = 2.69$, $p = .009$, $r = .43$. A Pearson's correlation indicated that there was no significant relationship

between decrease in mood from pre- to post-training and number of intrusive memories developed, r = -.240, p = .135, or between mood change and IES-R score, r = -.271, p = .095. There was a significant correlation between change in personal relevance ratings of the films pre- to post-training and number of intrusive memories, r = -.316, p = .03. However, after controlling for change in personal relevance, the effect of condition on intrusive memories remained, $F(1, 42) = 4.803$, p = .034. There was no significant correlation between change in personal relevance and IES-R scores, r = -.244, p = .300. Arousal ratings in response to the baseline test film clip were significantly correlated with IES-R score, r = .364, p = .009. However, after including these arousal ratings as a covariate, the effect of training on IES-R score remained, $F(1, 47) = 4.229$, p = .045.

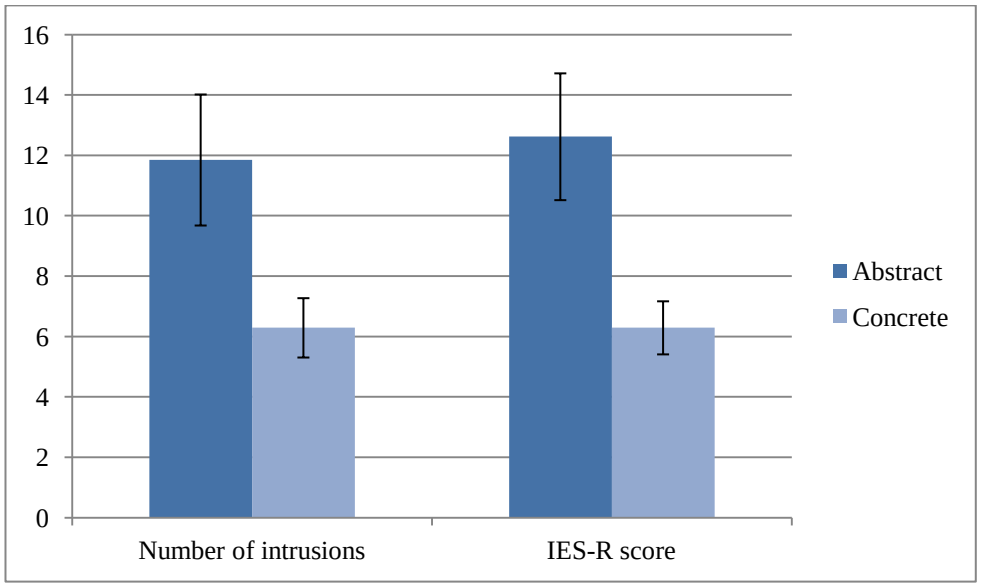

Figure 6. Number of intrusive memories and IES-R scores by group (means and standard errors are shown).

Table 10 shows the number of image- and thought-based intrusive memories by group. The concrete group reported significantly fewer image-based intrusive memories compared with the abstract group, although there was no difference between the two groups in thought-based memories.

Intrusive memories	Abstract Mean (SD)	Concrete Mean (SD)	t-tests
Image-based	8.88 (10.47)	3.86 (2.97)	$t(45) = 2.238$, $p = .030$
Thought-based	3.28 (4.20)	2.14 (3.20)	$t(45) = 1.343$, $p = .186$

Table 10. Means and standard deviations of image- and thought-based memories by group.

Figure 7 shows differences between conditions in individual IES-R subscales. The concrete group reported significantly lower scores on the intrusion subscale, $t(43) = 2.93$, $p = .005$, $r = .38$. There was a non-significant trend for the concrete group to report lower avoidance subscale scores, $t(48) = 1.74$, $p = .087$, $r = .24$, and hyperarousal scores, $U = 250.00$, $z = -1.662$, $p = .097$, $r = -.24$.

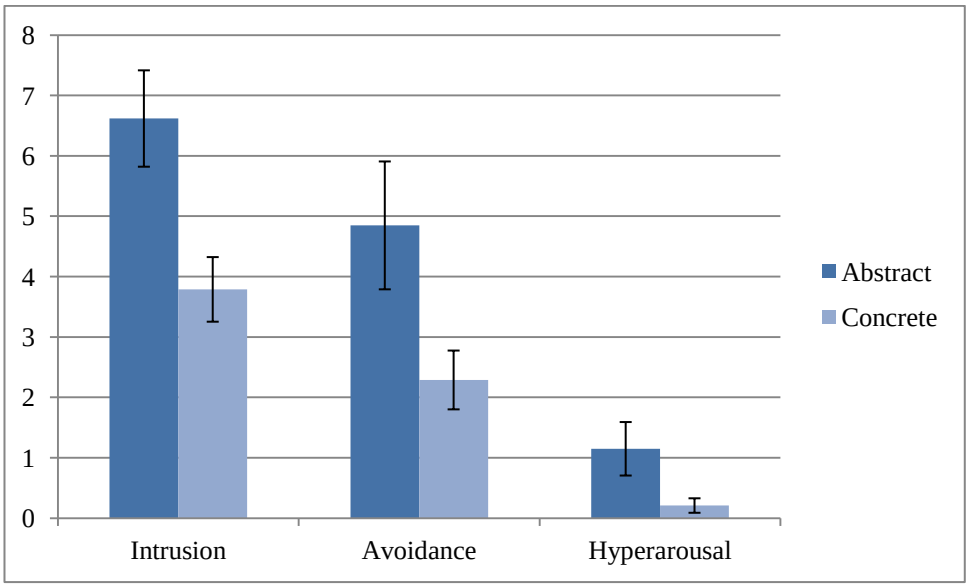

Figure 7. Individual IES-R subscale scores by group (means and standard errors are shown).

Summary: Hypothesis 1

As hypothesised, the concrete group reported significantly fewer intrusive memories in relation to the film clips during the following week, as well as lower IES-R scores one week later (including on the intrusion subscale). There was a trend towards the concrete group scoring lower on the avoidance and hyperarousal subscales. Although the abstract group reported a greater decrease in mood than the concrete group, this was not significantly related to the development of intrusive memories. The effect remained after controlling for personal

relevance , which was correlated with number of intrusive memories, and baseline subjective arousal, which was correlated with IES-R scores. These findings suggest that the first hypothesis, that participants trained to process traumatic stimuli in a concrete way will experience fewer intrusive memories than those trained to process the same stimuli in an abstract way, is supported.

3.3.2 Hypothesis 2: Participants who are trained to process the films in a concrete way will experience reduced emotional reactivity to a subsequent traumatic film compared with participants who are trained to process the films in an abstract way

Mixed ANOVAS were conducted to investigate changes in emotional reactivity measures between the groups. Effect sizes were derived using partial eta-squared (η^2_p), where $\eta^2_p = .01$ represents a small effect size, $\eta^2_p = .06$ a medium effect size and $\eta^2_p = .14$ a large effect size (Cohen, 1988). Paired samples t-tests were conducted to investigate pre- to post- differences in ratings within groups. Where shift in mood was correlated with outcome, this was included as a covariate.

Table 11 summarises emotional reactivity ratings of distress, horror, arousal and valence for both groups.

	Abstract Mean (SD)	Concrete Mean (SD)
Test film 1 distress	49.81 (23.34)	45.21 (25.43)
Test film 1 horror	47.12 (24.67)	41.46 (27.72)
Test film 1 arousal	39.81 (27.66)	23.75 (21.23)
Test film 1 valence	30.77 (13.17)	33.33 (12.99)
Test film 2 distress	65.77 (23.57)	45.21 (22.91)
Test film 2 horror	58.46 (26.79)	37.92 (29.78)
Test film 2 arousal	54.23 (30.35)	31.46 (26.11)
Test film 2 valence	23.08 (11.32)	31.67 (15.16)

Table 11. Means and standard deviations of emotional reactivity ratings for test films by group.

Mixed ANOVAs were conducted to investigate change in emotional reaction ratings in response to the pre- and post-training test film clips. For distress ratings, there was a main effect of time (pre- to post-training) on ratings of distress, $F(1, 48) = 5.95$, $p = .018$, $\eta^2_p = .110$, and a main effect of condition, $F(1, 48) = 4.554$, $p = .038$, $\eta^2_p = .087$. As Figure 8 illustrates, there was a significant interaction between change in distress ratings from pre- to post-training and condition, with the abstract group showing greater increases in distress in response to the second test clip compared with the concrete group, $F(1, 48) = .5.95$, $p = .018$, $\eta^2_p = .110$.

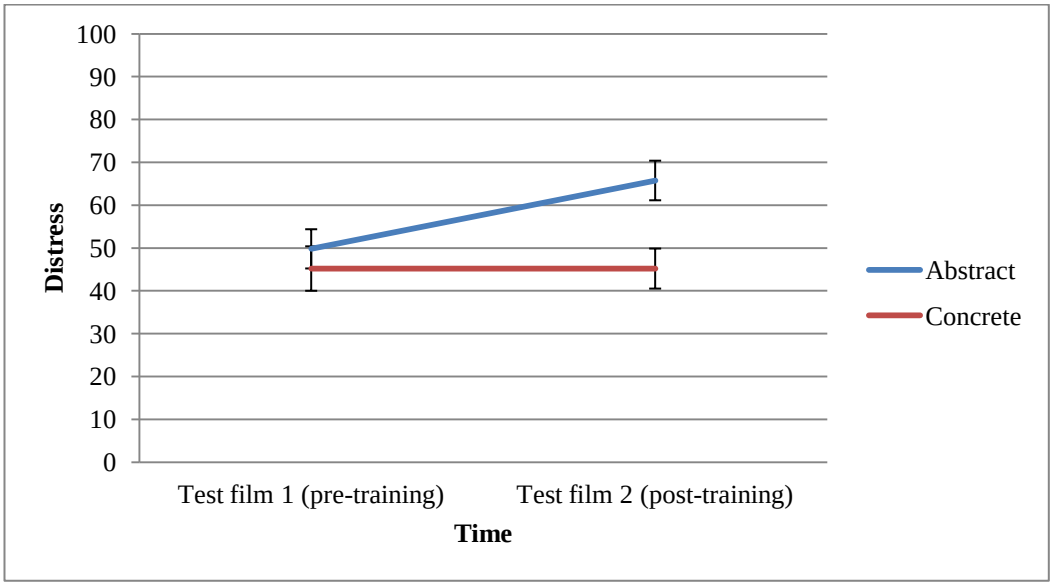

Figure 8. Change in distress ratings in response to pre- and post-training test film clips between groups.

Paired samples t-tests revealed that whereas there was no change in distress ratings to the test film clips from pre- to post-training in the concrete group, $t(23) = .001$, $p = .520$, there was a significant increase in distress ratings for the abstract group, $t(25) = -5.512$, $p = .001$. Independent samples t-tests revealed that whereas there was no significant difference between groups in pre-training test clip ratings, $t(48) = .667$, $p = .508$, the abstract group rated the post-training test clip as significantly more distressing than the concrete group, $t(48) = -3.123$, $p = .003$. There was a significant correlation between decreased mood and increase in distress, $r = -.320$, $p = .047$. However, an ANCOVA was conducted including change in mood as a covariate. This showed that, after controlling for decrease in mood, effect of condition on change in distress remained, $F(1, 35) = 5.976$, $p = .013$, $\eta^2_p = .159$. There was no correlation between change in distress rating and change in personal relevance, $r = .185$, $p = .436$, nor with baseline test film arousal ratings, $r = .083$, $p = .567$.

Figure 9 shows change in pre- and post-training test clip ratings of horror for both groups. There was a significant interaction between change in horror ratings from pre- to post-training test films and condition, with the abstract group showing greater increases in horror ratings in response to the second test clip compared with the concrete group, $F(1, 48) = 5.029$, $p = .030$, $\eta^2_p = .095$. There was also a main effect of time (pre- to post-training), $F(1, 48) = 1.382$, $p = .246$, $\eta^2_p = .028$, although no main effect of condition, $F(1, 48) = 3.544$, $p = .066$, $\eta^2_p = .069$.

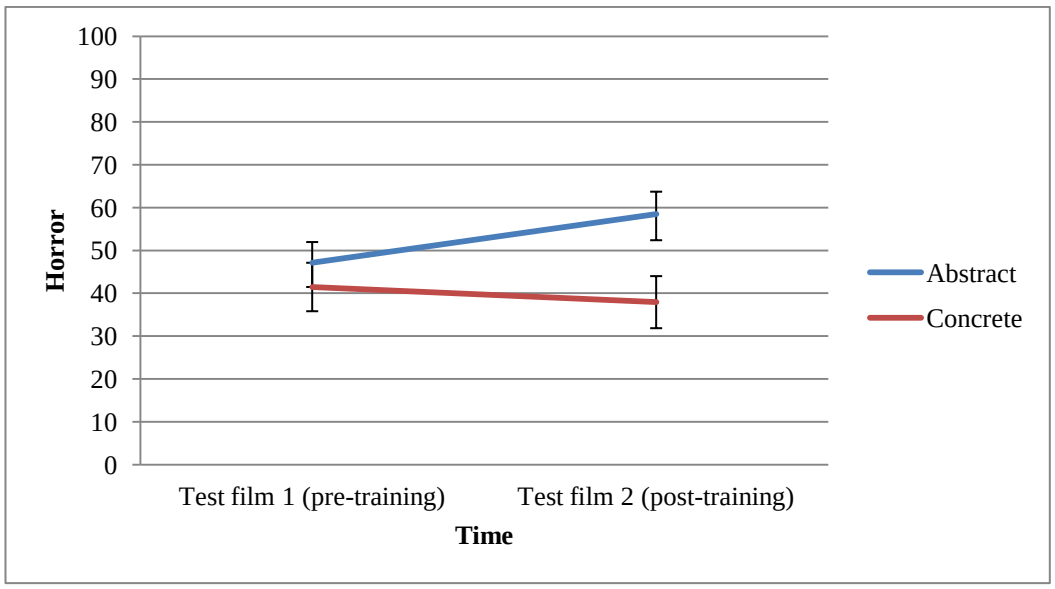

Figure 9. Change in ratings of horror in response to pre- and post-training test film clips between groups.

Paired samples t-tests revealed that whereas there was no change in horror ratings to the test film clips from pre- to post-training in the concrete group, $t(23) = .653$, $p = .520$, there was a significant increase in distress ratings for the abstract group, $t(25) = -2.867$, $p = .008$. Independent samples t-tests revealed that whereas there was no significant difference between groups in pre-training test clip ratings, $t(48) = .674$, $p = .449$, the abstract group rated the post-training test clip as significantly more distressing than the concrete group, $t(48) = 2.568$, $p = .013$. There was no significant correlation between increase in horror ratings and decrease in mood, $r = -.214$, $p = .191$, change in ratings of personal relevance, $r = -.039$, $p = .799$, or baseline arousal, $r = .079$, $p = .584$

Change in pre- and post-training test clip ratings of arousal between groups are shown in Figure 10. There was a main effect of time, $F(1, 48) = 10.47$, $p = .002$, $\eta^2_p = .179$, but no significant

interaction between time and condition, $F(1, 48) = .964$, $p = .331$, $\eta^2_p = .020$. This suggests that both groups reported a comparable increase in subjective ratings of physiological arousal in response to the second film clip. There was a main effect of condition however, $F(1, 48) = 8.334$, $p = .006$, $\eta^2_p = .148$, and as Figure 10 shows, the abstract groups ratings of arousal tended to be higher. There was a significant relationship between ratings of arousal and mood, $r = -.397$, $p = .012$, but not between ratings of arousal and personal relevance, $r = .022$, $p = .888$. Paired sampled t-tests revealed that both conditions reported an increase in arousal in relation to the second test clip, (abstract: $t(25) = -3.084$, $p = .005$; concrete: $t(23) = -1.542$, $p = .137$).

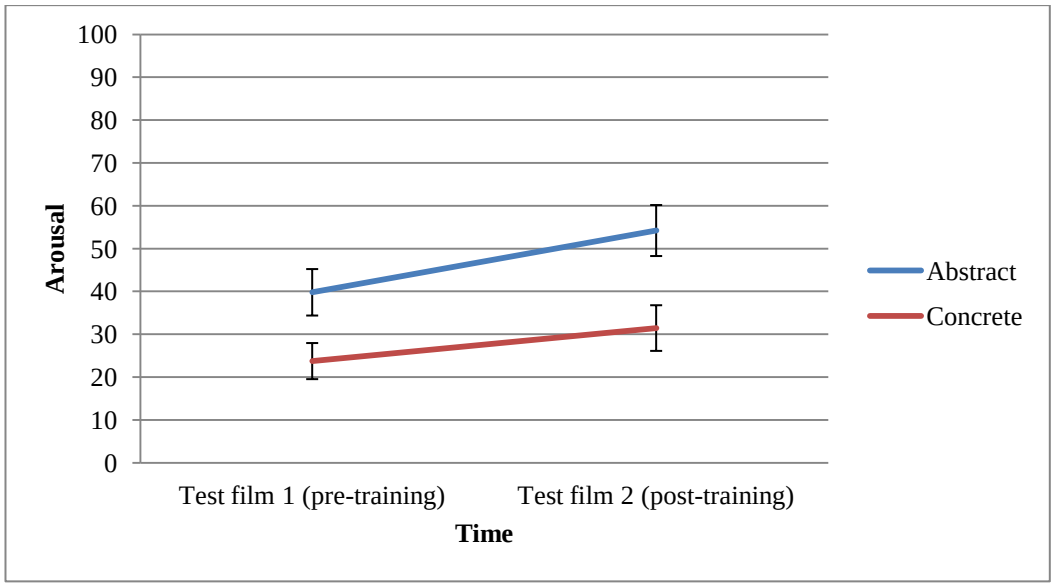

Figure 10. Change in ratings of arousal test film clips between groups in response to pre- and post-training test film clips between groups.

Pre- to post-training test film clip ratings of valence between condition are shown in Figure 11. There was a main effect of time $F(1, 48) = 5.00$, $p = .030$, $\eta^2_p = .094$, although no main effect of condition $F(1, 48) = 3.252$, $p = .078$, $\eta^2_p = .063$, and no interaction between time and condition, $F(1, 48) = 2.072$, $p = .156$, $\eta^2_p = .041$. However, paired samples t-tests showed that the abstract group reported a significant decrease in valence, $t(25) = 3.177$, $p = .004$, whereas the concrete group did not, $t(23) = .479$, $p = .636$. Ratings of valence were significantly correlated with mood, $r = .330$, $p = .040$, but not with personal relevance, $r = -.070$, $p = .647$.

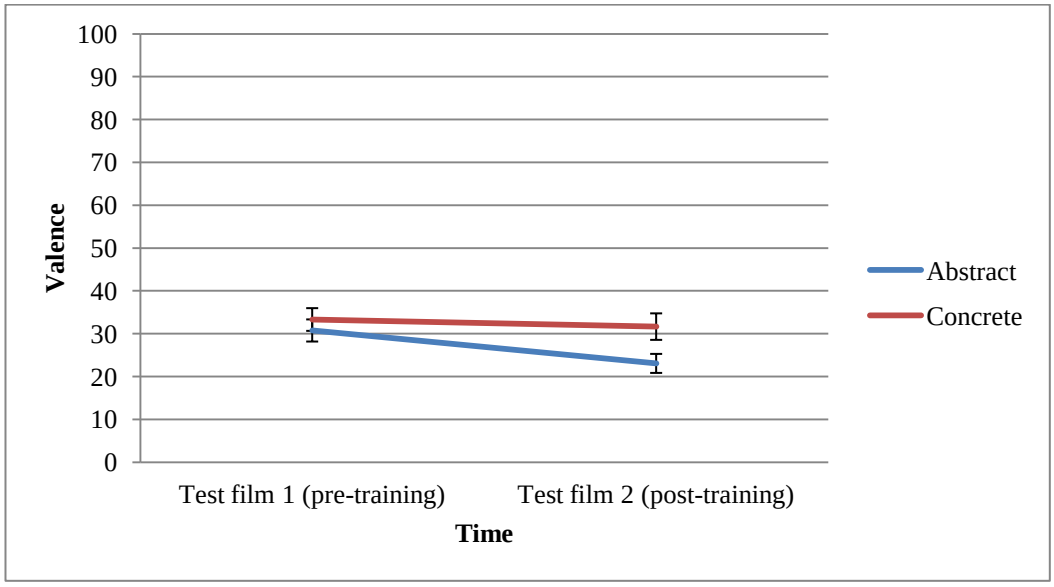

Figure 11. Change in ratings of valence of affect during test film clips in response to pre- and post-training test film clips between groups.

Summary: Hypothesis 2

Participants in the abstract condition demonstrated an increase in distress and horror from pre- to post-training in response to the test films, which was significantly greater than change in the concrete group, who demonstrated no increase in distress and horror. The effect of training condition remained even when controlling for shift in mood, which was significantly related to change in distress ratings. Both groups demonstrated an increase in self-reported arousal, although there was no difference in increase between the two groups. Groups did not significantly differ in the extent to which their valence of affect changed in response to the clip from pre- to post-training. These findings suggest that the second hypothesis, that participants trained to process the clips in a concrete way would lead to reduced emotional reactivity to the last test film compared with the abstract group, can be accepted, although this was limited to distress and horror ratings and did not extend to ratings of arousal or valence of affect.

3.3.3 Exploring the relationship of predictor variables to intrusive memories and IES-R scores

Relationships between individual predictor variables and number of intrusive memories reported were explored using Pearson's correlations. Individual predictors were then entered simultaneously into a hierarchical regression analysis. The order in which variables were entered was decided according to their theoretical importance based on the literature. Assumptions of multiple regression analyses were assessed and met. To explore potential interactions between condition and individual predictor variables in predicting number of intrusive memories, hierarchical regression analyses were carried out with condition (coded as a dummy variable: 0 = abstract, 1 = concrete) and the centred predictor variable score entered first, followed by the interaction term (cross-product of condition x variable score).

Individual Pearson's correlations between predictor variables and number of intrusive memories for the whole sample and by group are summarised in Table 12. Proneness to intrusions 1 (i.e. the tendency to experience intrusive memories in response to unpleasant or stressful events in everyday life) was significantly correlated with number of intrusive memories for the whole sample. Both proneness to intrusions 2 (the tendency to experience intrusive memories in response to unpleasant scenes on television) and proneness to intrusions 3 (the tendency to experience intrusive memories in response to positive events) were only significantly correlated with intrusions in the abstract group. Sleep difficulties in the two weeks prior to the test session were positively and significantly correlated with intrusive memories, although only in the concrete group.

	Whole sample	Abstract	Concrete
PTQ	r = .043, p = .765	r = -.017, p = .933	r = .169, p = .431
TDQ-s	r = -.164, p = .260	r = -.172, p = .412	r = -.166, p = .439
Proneness to intrusions 1	r = .350, p = .013	r = .354, p = .076	r = .363, p = .081
Proneness to intrusions 2	r = .225, p = .116	r = .421, p = .032	r = .047, p = .826
Proneness to intrusions 3	r = .245, p = .087	r = .492, p = .011	r = -.115, p = .591
ISI	r = .241, p = .092	r = .118, p = .566	r = .445, p = .029

Table 12. Correlations between predictor variables and intrusive memories.

Table 13 presents individual Pearson's correlations between predictor variables and IES-R scores for the whole sample and by group. ISI score was significantly positively correlated with

IES-R but only in the concrete group. Proneness to intrusions 1 was significantly correlated with IES-R score for in the abstract group.

	Whole sample	Abstract	Concrete
PTQ	r = .056, p = .700	r = .060, p = .770	r = .248, p = .242
TDQ-s	r = .059, p = .689	r = .052, p = .804	r = .113, p = .599
Proneness to intrusions 1	r = .270, p = .058	r = .400, p = .043	r = -.017, p = .937
Proneness to intrusions 2	r = .102, p = .481	r = .064, p = .757	r = .235, p = .270
Proneness to intrusions 3	r = .146, p = .313	r = .206, p = .312	r = -.243, p = .253
ISI	r = .040, p = .784	r = -.112, p = .587	r = .572, p = .003

Table 13. Correlations between predictor variables and IES-R scores.

Table 14 summarises the hierarchical regression analysis exploring relationships between the predictor variables and **intrusive memories**. As only the first proneness to intrusions scale was significantly correlated with intrusive memories for the whole sample (see Table 12), only this proneness to intrusions measure was entered into the model. In the first step, which included PTQ score, the overall model was not significant, $F(1, 47) = .088$, $p = .768$, and PTQ score did not significantly predict number of intrusive memories, $\beta = .04$, $t(48) = .297$, $p = .768$. In the second step, when the remaining variables were included (TDQs, proneness to intrusions, ISI), the model explained significant additional variance (21%) and the overall model became significant, $F(4, 44) = 3.990$, $p = .008$. Neither PTQ nor TDQs scores significantly predicted number of intrusions. However self-reported proneness to intrusive memories significantly predicted number of intrusive memories, $\beta = .43$, $t(48) = 2.996$, $p = .004$, as well as ISI scores, $\beta = .33$, $t(48) = 2.439$, $p = .019$.

	B	SE B	β	*p*
Step 1				
Constant	0.83	0.11		
PTQ	0.00	0.01	.04	.768
Step 2				
Constant	0.61	0.21		
PTQ	-0.00	0.01	-.09	.586
TDQ	-0.10	0.07	-.23	.137
Proneness	0.15	0.05	.43	.004
ISI	0.16	0.07	.33	.019

R^2 = .002 for step 1, ΔR^2 = .264 for step 2 (p = .003)

Table 14. Summary of hierarchical regression analysis for variables predicting number of intrusive memories (B = unstandardised beta, β = standardised beta).

Table 15 summarises the hierarchical regression analysis exploring relationships between the predictor variables and **IES-R scores**. In the first step, which included PTQ score, the overall model was not significant, $F(1, 47) = .911$, $p = .345$, and PTQ score did not significantly predict number of intrusive memories, $\beta = 0.14$, $t(48) = .955$, $p = .345$. In the second step, when the remaining variables were included (TDQs, proneness to intrusions, ISI), they did not explain significant additional variance. The overall model remained non-significant, $F(4, 44) = .964$, $p = .437$, and none of the predictors significantly predicted IES-R score.

	B	SE B	β	*p*
Step 1				
Constant	7.34	2.14		
PTQ	0.11	0.11	.14	.345
Step 2				
Constant	3.74	4.71		
PTQ	0.00	0.15	.00	.998
TDQ	0.02	1.51	.00	.989
Proneness	1.91	1.18	.26	.113
ISI	1.23	1.51	.13	.419

$R^2 = .019$ for step 1, $\Delta R^2 = .062$ for step 2 ($p = .410$)

Table 15. Summary of hierarchical regression analysis for variables predicting IES-R scores (B = unstandardised beta, β = standardised beta).

When condition and PTQ score were simultaneously entered into a regression analysis, the overall model was not significant, $F(2, 47) = 2.254$, $p = .116$. Condition significantly predicted number of intrusions $\beta = -.29$, $t(49) = -2.100$, $p = .041$, whereas PTQ did not, $\beta = .08$, $t(49) = .544$, $p = .589$. In the second step when the interaction term of PTQ and condition was included, the overall model did not explain additional variance and the model remained non-significant, $F(3, 46) = 1.597$, $p = .203$. The interaction did not significantly predict number of intrusions, $\beta = .13$, $t(49) = .588$, $p = .559$. When condition and TDQ-s score were entered simultaneously into a regression analysis, the overall model was not significant, $F(2, 46) = 2.834$, $p = .069$, and TDQs did not significantly predict number of intrusions, $\beta = -.16$, $t(48) = -1.161$, $p = .252$, whereas condition did, $\beta = -.29$, $t = -2.068$, $p = .044$. In the second step when the interaction between training condition and TDQ-s was included, this did not significantly predict number of intrusive memories, $\beta = -.01$, $t(48) = -.052$, $p = .959$.

When condition and proneness to intrusions scale score were simultaneously entered into a regression analysis, the overall model was significant, $F(2, 47) = 5.846$, $p = .005$, and both

condition and proneness significantly predict number of intrusions, β = -.28, $t(49) = -2.119$ $p = .039$ and β = .34, $t(49) = 2.625$, $p = .012$ respectively. With the inclusion of the interaction term (cross-product of condition x proneness to intrusions score) in the second step, the model remained significant, $F(3, 46) = 3.827$, $p = .016$, although the interaction did not explain significant additional variance and did not predict number of intrusive memories, β = .03, $t(49) = .173$, $p = .864$.

Finally, when condition and ISI score were simultaneously entered into a regression analysis as a first step, the overall model was significant, $F(2, 47) = 3.589$, $p = .035$, although ISI did not significantly predict number of intrusions, β = .23, $t(49) = 1.658$, $p = .104$, although there was a non-significant trend of condition, β = -.27, $t(49) = -2.008$, $p = .050$. In the second step, when the interaction term (cross-product of condition x ISI score) was included, the model did not explain significant additional variance, although the model remained significant, $F(3, 46) = 3.251$, $p = .030$. However, the interaction between ISI scores and condition did not significantly predict number of intrusive memories, β = .24, $t(49) = 1.538$, $p = .131$.

Summary

As hypothesised, people with a greater tendency towards developing intrusive memories in response to stressful events in their everyday lives and people with greater sleep difficulties in the previous two weeks were more likely to develop intrusive memories in response to the film clips. However, trait rumination and dissociation were not significant predictors. Furthermore, there were no interactions between any of the predictor variables and condition in predicting intrusions. This means that the relationship between predictor variables and intrusions did not depend on training condition.

3.4 Summary of results

There were no differences found between the groups across a range of baseline state and trait measures, although the abstract group reported significantly greater subjective arousal in response to the first test clip. The validity of this measure is discussed in further detail in the Discussion. As hypothesised, the concrete group reported fewer intrusive memories in relation to the film clips in the week following the test session and lower scores on the IES-R total scale and intrusion subscale. There were non-significant trends towards the concrete group having lower scores on the avoidance and hyperarousal subscales. The concrete group reported fewer image-based memories in particular. Both groups demonstrated a decrease in mood from pre- to post-training, although this was not correlated with number of intrusions developed or IES-R scores. After controlling for the increase in personal relevance of the second film clip for both groups, which was correlated with intrusive memories, the effect of the training condition remained. The effect also remained after controlling for arousal in response to the first clip, which was correlated with IES-R score.

Consistent with hypotheses, the abstract group demonstrated a significantly greater increase in distress and horror after training in relation to the second test film clip compared with the first, compared with the concrete group whose distress and horror ratings did not increase. The effect of condition on post-training distress ratings remained after controlling for decrease in mood, which was correlated with increase in distress. Both groups showed a comparable increase in arousal, with both reporting more arousal in response to the second test film clip. However, the groups differed in their arousal ratings for the first test film clip, with the abstract group reporting more arousal. Both groups reported decreases in valence (i.e. the degree to which they felt negative during the film clips), which were not significantly different.

Finally, it was found that self-reported proneness to intrusive memories in everyday life and sleep difficulties significantly predicted number of intrusive memories in response to the film clips. Trait rumination and dissociation failed to predict number of intrusive memories, and interactions between predictor variables and condition also did not predict intrusive memories.

4. Discussion

This study had three aims. The primary aim was to investigate whether being trained to process an analogue trauma in a concrete way would lead to fewer intrusive memories of it compared with processing the same stimuli in an abstract way. The second aim was to investigate whether undergoing concreteness training would reduce emotional reactivity (distress, horror, arousal and negative affect) to a subsequent traumatic film. Finally, the third aim was to explore the relationship of certain predictor variables previously linked to PTSD (trait rumination and dissociation, proneness to intrusions, sleep difficulties), to the number of intrusive memories developed in response to the traumatic film clips.

4.1 Summary of findings and comparison to previous literature

The analogue trauma was successful in inducing intrusive memories with 94% of participants reporting at least one spontaneous intrusive memory of the film clips. The primary hypothesis, that the concrete group would experience significantly fewer intrusive memories in relation to the film clips compared with the abstract group, was supported. The concrete group reported fewer spontaneous intrusive memories of the film clips in their intrusion diaries in the following week and significantly lower scores on the Impact of Events Scale-Revised (IES-R) one week later, including lower scores on the intrusion subscale. The concrete group reported fewer image-based memories in particular, which are characteristic of intrusive memories experienced in PTSD (Ehlers *et al.,* 2004; van der Kolk & Fisler, 1995). There were trends towards the concrete group reporting lower scores on the avoidance and hyperarousal subscales although these did not reach statistical significance.

As hypothesised, concrete processing training led to reduced distress and horror ratings in relation to the final test film clip compared with abstract processing, although this did not extend to arousal and overall negative affect. Finally, as predicted, self-reported proneness to intrusions significantly predicted number of intrusive memories developed, in that those with a higher tendency to experience intrusions relating to negative events in their everyday lives were more likely to develop intrusions in response to the film clips. Sleep difficulties were also a significant predictor of number of intrusive memories, with greater self-reported sleep problems in the previous two weeks associated with a higher number of intrusions. Contrary to

predictions, neither trait rumination nor trait dissociation predicted number of intrusions. There were no interactions between individual trait variables and training condition in predicting number of intrusive memories.

4.1.1 Intrusive memories

The finding that concrete processing led to fewer intrusions than abstract processing supports findings from analogue studies of depression, showing that processing a stressful event (an induced failure task) in a concrete way afterwards leads to fewer intrusive memories than processing it in an abstract way (Watkins, 2004; Watkins & Moulds, 2004), although the present study examined peri-traumatic rather than post-traumatic processing. The current study supports research showing correlational evidence linking a ruminative, abstract style of processing to PTSD symptoms (e.g. Ehring *et al.* 2009; El-Leithy *et al.* 2006; Michael *et al.* 2007; Zetsche *et al.* 2009). However, at present, this appears to be the first study to show that processing mode is causally involved in the development of PTSD symptoms such as intrusive memories, and that concrete processing may protect against the development of intrusions.

There are a number of possible explanations as to why concrete processing led to fewer intrusive memories in the week following the task. First, it is possible that the concrete mode facilitated contextualised processing, by encouraging focus on details and the temporal sequence of events. Consistent with cognitive models of PTSD (Brewin *et al.,* 1996; Ehlers & Clark, 2000), this potentially led to a memory of the analogue trauma that was more elaborated and organised and less likely to intrude into consciousness later on compared with the abstract group. The concrete mode of processing may have also generated situation-specific appraisals, enabling participants to perceive the analogue trauma as a time-limited event and thus reducing any sense of ongoing threat. The abstract mode of processing on the other hand may have prevented contextualised processing, generating a more disorganised memory, which was less elaborated, less integrated into other memories and therefore more easily triggered. In addition, because of its focus on broader meanings and implications, this mode of processing may have led to overgeneralised negative appraisals (e.g. overestimations of danger). A disorganised memory and generalised negative appraisals may have led to a greater sense of ongoing threat in the abstract group compared with the concrete group, leading to increased distress and intrusive memories. These processes, (i.e. decontextualised peri-traumatic processing leading to a disorganised trauma memory and negative overgeneralised appraisals) are hypothesised to be

important factors in the development of intrusive memories, creating a sense of ongoing threat and additional symptoms such as avoidance and hyperarousal (Brewin *et al.,* 1996; Ehlers & Clark, 2000). The concrete mode may also have had other beneficial effects, for example by facilitating emotional processing of the trauma (e.g. Borkovec *et al.,* 1998; Teasdale & Barnard, 1993) or reducing anxiety by focusing attention on the immediate environment (e.g. Leary *et al.,* 2006).

A second possible explanation is that, it was a lowering of mood rather than a difference in processing mode that was responsible for the abstract group developing more intrusions since low mood is linked to greater frequency of intrusions (Davies & Clark, 1998b). Both groups reported a significant decrease in mood over the course of training, which was more pronounced in the abstract group. This is consistent with previous studies showing a similar differential effect of processing mode on mood (e.g. Ehring *et al.,* 2009; Watkins, 2004; Zetsche *et al.,* 2009). However, the intrusive memories that participants reported tended to include films that were viewed throughout the whole testing session, rather than solely those viewed towards the end of the session when the abstract group was lower in mood. Furthermore, participants experienced intrusive memories over the course of a few days and up to a week, whereas any mood induction effect was likely to have been short-lived (i.e. less than a day; e.g. Watkins, 2004). In addition, change in mood over the testing session was not significantly associated with the number of intrusive memories developed or IES-R scores. For these reasons, it is unlikely that is was solely a greater decrease in mood which led to an increased number of intrusive memories in the abstract group.

Third, it could be argued that, given that the abstract group gave higher subjective ratings of arousal in response to the first test clip, this was responsible for their higher reported levels of distress, horror and intrusive memories in response to the film clips. However, arousal ratings in relation to the first clip were not significantly correlated with number of intrusive memories, neither were they correlated with the hyperarousal scale of the IES-R. Arousal ratings were significantly correlated with IES-R scores, although after controlling for these the effect of condition remained. Between-group differences in self-reported arousal need to be interpreted with caution. First, whilst participants were asked to rate their subjective levels of physiological arousal, no objective measures were available to support these ratings. Second, this difference was inconsistent with a range of other state measures, which are typically correlated with arousal (e.g. mood, distress, horror, negative affect) and on which groups were equivalent, as well as on ratings of personal relevance of the film clip and trait anxiety. Third, it was observed

that many participants did not understand what was meant by the term 'arousal.' Although these limitations do not explain why the abstract group had higher subjective arousal ratings, it raises questions about the validity of this measure. Discrepancies between self-reports of arousal and physiological measures of arousal have previously been reported (Shepherd, 2008).

Fourth, given that the abstract condition's training included instructions which encouraged them to think about the films in a more personally relevant way (e.g. 'What if this happened to you or someone in your family?') it could be argued that the abstract group experienced the film as more self-relevant, which led them to experience more intrusive memories. Increased self-relevance of the film clips may be expected to increase distress and intrusive memories through increasing sense of threat and personalised negative appraisals. However, no difference was found between the groups in change in personal relevance ratings from pre- to post-training. Furthermore, although an increase in personal relevance of the test film clips from pre- to post-training was correlated with number of intrusive memories, the effect of training condition on intrusive memories remained even when controlling for this increase.

Comparison to the literature

Previous studies (e.g. Ehring *et al.,* 2009; Zetsche *et al.,* 2009) have failed to find a differential effect of processing mode on intrusive memories developed in response to an analogue trauma. As these studies manipulated post-traumatic rather than peri-traumatic processing mode, it is possible that it is the mode in which traumatic events are processed at the time which is important in determining the development of PTSD symptoms. However, analogue studies of depression have shown that post-event processing mode influences the development of intrusive memories. Furthermore, both Wells and Papageourgiou (1995) and Butler and Dewick (1995) showed that worrying about an analogue trauma, which is characterised by an abstract style of thinking, increased the rate of intrusions relative to controls.

It may be that the way in which participants were trained accounted for the differential impact of processing mode in the current study. It adopted a cognitive bias modification (CBM) training procedure, whereby participants received repeated verbal and written instructions and prompts and were able to practise applying the assigned processing mode to a series of training films clips. The significant effect of processing mode on intrusive memories in this study,

compared with others using the trauma film paradigm, may therefore have been due to participants being trained in a more systematic way. Woud *et al.* (2011) highlighted that many trauma film paradigm studies seek to induce a specific type of appraisal or processing style in one attempt, whereas it might be more effective to use a training paradigm (e.g. using CBM methodology) to induce the particular appraisal style.

The instructions themselves also differed in the current study from Zetsche *et al.* (2009) and Ehring *et al.* (2009), which may account for the discrepant findings. Although Ehring *et al.*'s (2009) concrete instructions were validated as concrete by independent raters, the authors acknowledged that their concrete instructions may not have been sufficiently different from abstract instructions. For example, their concrete instructions contained questions such as 'what are the reasons for accidents happening?' and 'what would the consequences be on my life?' It could be argued that such questions guided participants into an abstract way of thinking because they appear closely linked to questions relating to 'Why?', 'What if?', and the implications of events. Although in Zetsche *et al.*'s (2009) study the memory integration condition contained questions that resembled concrete processing, their instructions aimed to promote memory integration rather than concrete processing per se. (e.g. asking participants to think about what they had done and how they had felt before coming to the session, asking which scenes they found the most unpleasant and why, and how the scenes were similar or different to their own experiences).

4.1.2 Emotional reactivity

The finding that concreteness training lowered emotional reactivity (distress and horror) to the second test film clip supports Watkins *et al.*'s (2008) observations relating to the effect of processing mode training on emotional reactivity in an analogue study of depression. They found that training participants to process scenarios in a concrete way led to reduced despondency in response to a later analogue failure task compared with participants who were trained to process the scenarios in an abstract way. The findings also support those of Schartau *et al.* (2009), on which the current study paradigm was based, which showed that training participants to appraise traumatic film clips in a more functional way leads to reduced emotional reactivity (distress and horror) in response to exposure to a subsequent traumatic film clip. However, the current study extends their findings by providing preliminary evidence that, in

addition to the content of appraisals, the mode in which traumatic information is processed can lead to reduced emotional reactivity to a subsequent analogue trauma.

Contrary to predictions, the training condition did not have a differential impact on self-reported levels of arousal or valence of affect. As discussed in Section 3 above, the measure of arousal used should be interpreted with caution. Schartau *et al.* (2009) advocated using ratings of distress and horror as indices of emotional reactivity, arguing that generalised emotion terms such as distress are a reliable index of change in emotional reactivity in response to experimental manipulations (Richards & Gross, 2000), as well as being commonly used in clinical settings (Dalgleish & Yiend, 2006). They also highlight that the emotion categories of distress and horror are historically associated with traumatic events (APA, 1994). The use of the term 'arousal' appeared to be unclear to participants. Some participants interpreted it to mean general physiological arousal whereas others interpreted it to mean sexual arousal. Researchers in the field recommend the use of terms such as 'distress' and 'horror' as being more easily understood. Furthermore, existing research suggests there is a poor relationship between subjective and objective measures of arousal (Shepherd, 2008). The lack of observed difference in change in degree of negative affect (valence) may have been due to this measure being a less sensitive measure of change in emotional reactivity in response to traumatic stimuli compared with horror and distress.

4.1.3 Relationship of predictor variables to intrusive memories

The present study found that trait rumination was unrelated to the number of intrusive memories developed. Zetsche *et al.* (2009) found that state rumination measured using the Perseverative Thinking Questionnaire-State Version (PTQ-S; Ehring *et al.*, 2010) was positively associated with number of intrusive memories, although they did not look at trait rumination. Watkins (2004) found an interaction between trait rumination and processing mode in the development of intrusions following an analogue failure experience, although this was not found in the present study. It is possible that in the present study, peri-traumatic processing mode was a more important predictor than a trait ruminative style of thinking. Trait dissociation, was also unrelated to the number of intrusive memories developed, which is inconsistent with Murray (1997) who found that higher trait dissociation was associated with a higher number of intrusive memories over the following week. Again, the lack of relationship between trait dissociation and intrusive memories in this study may have been due to processing mode being a more

powerful predictor, although findings on the relationship of dissociation and intrusive memories have in general been mixed (see Laposa & Rector, 2012).

As hypothesised, self-reported proneness to intrusive memories significantly predicted number of intrusive memories in the current study. Participants who reported an increased tendency to experience intrusive memories in response to stressful or negative events in their everyday lives reported a higher number of intrusive memories in relation to the film clips. This is consistent with Davies and Clark (1998b) who found that a higher level of self-reported proneness to intrusive memories predicted a higher number of intrusive memories in response to a trauma film. Greater sleep difficulties in the two weeks prior to the testing session also predicted a higher number of intrusive memories. This supports Mellman *et al.*'s (2005) findings that among survivors of Hurricane Andrew, pre-trauma sleep disturbance was associated with higher symptom levels of PTSD, although this was based on retrospective ratings. The current study provides prospective evidence that pre-trauma sleep difficulties may increase vulnerability to developing PTSD symptoms after a trauma.

4.2 Theoretical implications

Findings from the present study provide support for previous literature highlighting peri-traumatic cognitive processing as a key factor influencing distress and the development of intrusive memories following trauma (Brewin *et al.*, 1996; Ehlers & Clark, 2000; Holmes *et al.*, 2004, Laposa & Alden, 2006). Current cognitive models of PTSD do not explicitly outline how processing mode (i.e. abstract versus concrete processing) may influence the development of intrusive memories. However, Ehring *et al.* (2009) drew upon Ehlers & Clark's (2000) cognitive model of PTSD in explaining how abstract processing during trauma-related rumination may contribute to the development of PTSD symptoms (e.g. intrusive memories). This model highlights two key processes that are instrumental in the development and maintenance of PTSD symptoms. The first is a disturbance in the autobiographical memory of the event, which is disjointed and lacks contextual information such as time and sequence of events. The second is negative appraisals of the trauma and its sequelae, which include overgeneralisations (e.g. 'the world is a dangerous place', 'I attract disaster', 'my future is ruined'). According to Ehlers and Clark (2000), these processes interact to maintain a sense of current threat, which motivates the use of maladaptive coping strategies, including rumination.

Ehring *et al.* (2009) suggested that an abstract style of processing when thinking about a trauma afterwards, such as when engaging in rumination, may contribute towards the development of PTSD symptoms such as intrusive memories by interfering with the elaboration and contextualisation of the trauma memory, which is needed for it to be integrated into autobiographical memory, and the modification of negative appraisals. This would require processing to occur on a concrete level, which would be expected to promote the contextualisation of the memory and facilitate change in negative, overgeneralised appraisals. With regard to the present study, it is equally plausible that an abstract style of processing *during* a trauma may also prevent the formation of a coherent trauma memory that contains contextual details so that the individual is unable to see it as a time-limited event and may generate overgeneralised appraisals about the self, the world and the future.

Furthermore, both Ehlers and Clark's (2000) model and Brewin *et al.*'s (1996) dual representation theory of PTSD highlight that functional processing of a trauma requires a balance of two peri-traumatic processing styles: a verbal or conceptual style concerned with meaning, organising information and placing it in context; and a data-driven or sensory style, which encodes sensory impressions. Brewin *et al.* (1996) distinguished between higher-level conscious processing of a trauma via the verbally accessible memory (VAM) system and lower-level processing via the situationally accessible memory (SAM) system. VAM processing forms verbal-narrative memories which contain contextual information and allow the trauma to be discriminated from other experiences. These representations prevent lower-level image-based memories from the SAM system, which lack information such as time code, from intruding involuntarily into consciousness; therefore a lack of VAM processing increases the development of intrusions. Similarly, Ehlers and Clark (2000) distinguished between conceptual and data-driven processing, the latter leading to a disjointed, disorganised memory which lacks time code and is easily triggered by cues. As intrusive memories are usually linked to the worst moments of a trauma, for example, when the meaning changes for the worse, these cues tend to be sensory stimuli occurring in close temporal proximity to that moment ('the warning signal hypothesis'; Ehlers *et al.*, 2002).

Studies using trauma film paradigms have provided correlational and experimental evidence for the role of verbal-conceptual versus sensory-perceptual processing in the development of intrusive memories (Halligan *et al.*, 2002; Holmes *et al.*, 2004). Laposa and Alden (2008) found that participants who processed a traumatic film in a way that resembled conceptual processing led to fewer intrusive memories than controls.

Although the present study did not seek to manipulate verbal-conceptual versus sensory-perceptual processing, it is possible that the concrete mode shares functional properties with a verbal-conceptual mode of processing. For example, both styles of processing aim to form a coherent memory of the trauma which is contextualised in place and time. Although an abstract mode of processing does not resemble sensory-perceptual processing, it may represent another type of unhelpful peri-traumatic processing leading to insufficient processing of details and context, a memory of the trauma that is disorganised and poorly integrated into autobiographical memory, as well as promoting overgeneralised representations and appraisals which maintain distress. Consistent with cognitive models of PTSD (e.g. Brewin *et al.*, 1996; Ehlers & Clark, 2000), this may give rise to intrusive memories that perpetuate a sense of current threat, leading to avoidance, hyperarousal, and maladaptive coping strategies which maintain symptoms. Such strategies may include rumination or worry, characterised by an abstract mode of processing which are therefore likely to prevent contextualisation of the trauma memory and modification of appraisals. The findings appear to also support treatment implications of these models, for example, using imaginal re-living and cognitive restructuring (Ehlers & Clark, 2000), which may help sufferers switch to a more concrete mode of processing.

As well as being compatible with cognitive models of PTSD, the present findings may also be explained in light of transdiagnostic theoretical accounts of how processing mode affects outcome. One explanation is that a concrete mode of processing is more adaptive because it facilitates problem solving (Stöber, 1998; Vallacher & Wegner, 1987; Watkins, 2008) by focusing on the means to an end rather than the end itself. It is unlikely in the current study that the concrete mode of processing facilitated problem-solving as such, since participants were watching a film clip and were not trying to achieve a personal goal. However, it is plausible that the concrete mode of processing reduced distress by directing attention at the immediate context, focusing on steps and actions as they were occurring and what steps would need to occur next to move the event forward, focusing attention away from the desirability of alternative outcomes and the general meaning of the event. Another explanation of the differential effects of processing, mode is that an abstract mode of processing fosters generalisations across situations, time and people, thereby strengthening overgeneralised appraisals which are implicated in a range of emotional disorders (Beck, 1976). Concrete appraisals on the other hand are thought to reduce these overgeneralisations and promote situation-specific, contextualised representations. This explanation is consistent with cognitive models of PTSD as discussed above. Other possible mechanisms of effect include the concrete mode facilitating emotional processing of the analogue trauma, consistent with Stöber's (1998)

and Teasdale and Barnard's (1999) accounts of how mode of processing has a differential effect on outcome.

Although the current study did not support previous findings that trait rumination or dissociation was associated with intrusive memories, it was consistent with Davies and Clark's (1998b) findings in showing that self-reported proneness to intrusive memories significantly predicted intrusive memories. The current study found that it was a tendency to develop intrusive memories of stressful and negative events in people's lives that predicted the development of intrusions in response to the films, rather than a tendency to develop intrusive memories of unpleasant films or of positive events. These findings suggest that, although intrusive memories are common in non-clinical populations (e.g. Berntsen, 1996; Mace, 2005), some individuals experience them more than others and this may be a risk factor for developing PTSD symptoms following trauma. Given that intrusive memories are also a feature of other disorders (e.g. depression), it is possible that they constitute a vulnerability factor to other disorders as well.

The finding that sleep difficulties predicted intrusive memories suggests that sleep may be a potential vulnerability factor towards developing intrusions following trauma. This supports previous literature on the relationship between sleep and PTSD suggesting that as well as being a consequence of PTSD, pre-existing sleep problems may be a vulnerability factor in its development (Mellman *et al.,* 2005) and that early sleep difficulties following trauma have been found to predict later development of PTSD symptoms (Koren *et al.,* 2002). The relationship between sleep difficulties and PTSD needs further investigation (Harvey *et al.,* 2003). One possible explanation for the etiological role of sleep difficulties in PTSD is that they may disrupt memory consolidation, for which sleep is important (Stickgold, 2005).

4.3 Occupational implications for at-risk groups

Findings from the current study have implications for the potential prevention of intrusive memories in occupational groups who are regularly exposed to trauma, such as ambulance and other emergency service personnel, journalists working in conflict zones and military personnel. Studies investigating the prevalence of PTSD among ambulance workers have found increased symptom levels compared with the general population (Sterud *et al.,* 2006). The current findings regarding the effects of processing mode could inform training programmes aimed at

preventing intrusive memories and enhancing psychological well-being among these at-risk groups.

Given the complexities of a real-life trauma compared with an analogue trauma, such training programmes would need to be carefully tailored to the target population. This may involve educating workers about the potentially helpful effects of a concrete style of processing relative to an abstract style of processing, with relevant examples. It should perhaps avoid using the terms abstract and concrete, which could be easily misunderstood. Care should also be taken to ensure that individuals understand that a concrete mode of processing does not involve suppression of thoughts or emotions or thinking positively, which may be harmful. Preventative interventions could also incorporate other factors that have been shown to reduce PTSD symptoms and associated distress, such as interpretations of intrusive memories (Woud *et al.*, 2011). Woud *et al.* (2011) used an implicit computerised reappraisal training paradigm with healthy participants following an analogue trauma, targeting appraisals of self-efficacy and of responses to the trauma films including emotions and intrusions. Participants were trained in either positive or negative appraisal using a series of sentences where the meaning (positive or negative) was only apparent by the last word. Those who underwent positive appraisal training (e.g. 'In a crisis I predict my responses will be *helpful*') reported fewer film-related intrusions over the following week and lower scores on the IES-R, compared with those who underwent negative training (e.g. 'In a crisis I predict my responses will be *useless*').

One potential difficulty with applying these findings to groups such as ambulance workers would be increasing the cognitive demand on workers who are trying to carry out a job. For this reason, it would be important to investigate whether the current findings can be extended to manipulating processing mode when thinking about a trauma after as opposed to during the event, as has been shown in other studies looking at peri-traumatic processing (e.g. Holmes *et al.*, 2004; Schartau *et al.*, 2009). Nevertheless, compared with studies showing similar beneficial effects of reappraisal on emotional reactivity to analogue trauma (e.g. Schartau *et al.*, 2009), a concrete mode of processing, which is focused on style of appraisal, may be expected to place fewer cognitive demands on individuals compared with other types of reappraisal focused on changing the content.

4.4 Limitations

Several limitations merit discussion when drawing conclusions from this study. The first limitation is that there was no objective physiological measure of arousal to support participants' subjective ratings. It is therefore unclear whether the differences observed between the two groups were due to real differences in arousal or were a result of having an invalid measure. As discussed previously, it seems likely that the subjective ratings of arousal lacked validity, given that groups were equivalent on other measures of mood and emotional reactivity and that many participants struggled to understand what was meant by arousal.

A second limitation concerns the lack of a no training control group. This makes it difficult to determine whether the differential effect of the processing mode manipulation was due to beneficial effects of concrete processing or to detrimental effects of abstract processing, or due to both effects occurring simultaneously. However, the inclusion of a no training condition has its own limitations, in that the experimenter would have limited control over the way in which participants processed the clips due to individual differences in processing style. Some individuals may naturally have processed in an abstract or concrete way. Nevertheless, it would have been useful to explore this to contrast both abstract and concrete processing to a no training control group.

A third limitation concerns the measure of personal relevance, which was included in order to assess to what extent the participants thought about themselves in relation to the film clips. The term 'personal relevance', however, may have been interpreted as the extent to which the clips fitted with their own experience and lives, rather than the extent to which they were focused on themselves while watching the clips. It may have been more accurate to use a measure of self-focus (i.e. to what extent participants were thinking of themselves in relation to the clip and applying it to their own lives).

A fourth limitation is that the possibility of demand effects influencing the participants' emotional reactions and number of intrusive memories in response to the film clips cannot be ruled out. For example, it is possible that based on the nature of the instructions given to them, the abstract group may have had a higher expectation of being distressed and developing intrusions than the concrete group, whose instructions were less emotive. However, both

groups were focusing on negative content, rather than one condition generating positive appraisals and the other generating negative. Also, previous trauma film studies have failed to find evidence of demand effects (e.g. Holmes *et al.*, 2006; Schartau *et al.*, 2006). It therefore seems unlikely that the current findings could be accounted for solely by differences in expectations.

Fifth, although this study provides preliminary evidence that processing mode influences the development of intrusive memories following an analogue trauma, it is difficult to ascertain the precise mechanism of effect. For example, although the manipulation targeted mode rather than content of processing, this could have inadvertently led to different valence of processing where the concrete group's instructions led them to have less negative appraisals. However, if this occurred, it may merely be an inevitable by-product of manipulating level of construal. Because abstract processing promotes generalised processing, these appraisals may be inherently more negative when faced with negative events. Nevertheless, it would have been useful to have an objective measure of processing mode (i.e. abstract versus concrete) and valence of appraisals. In addition, although decrease in mood was not significantly correlated with number of intrusive memories or IES-R scores, it is unclear to what extent participants' mood or emotional reactions to the clips mediated the development of intrusive memories. Davies and Clark (1998b) found that increases in negative mood following an analogue trauma were associated with an increased number of intrusive memories in response to the film in the following week.

A final limitation relates to the generalisability of the findings from this study, from non-clinical participants (predominantly students) in a laboratory setting to individuals who are exposed to real-life traumatic events. It is unclear whether a concrete mode of peri-traumatic processing could be successfully induced during a real-life traumatic event, such as during a traumatic emergency service call-out for ambulance workers, and whether it would be successful in protecting against distressing intrusive memories under these conditions. There is an extant literature outlining a host of pre-, peri- and post-traumatic vulnerability factors implicated in the development of PTSD (Brewin *et al.*, 2000; Ozer *et al.*, 2003), which are particularly difficult to control in a real-life setting. As discussed in the previous section, one of the difficulties with generalising the current findings to real-life traumatic events is the cognitive demand that peri-traumatic processing manipulations may impose on individuals.

4.5 Future research

As the present study appears to be the first to show a potential causal role of processing mode in the development of intrusive memories, it is important that the findings are replicated before being piloted in a real-life setting (e.g. with ambulance workers), taking account of some of the limitations described above, to better establish the reliability of the experimental effect. It would be useful to include a physiological index of arousal, such as skin conductance response or heart rate. It would also be useful to explore potential discrepancies between these measures and subjective ratings of arousal.

In order to better establish whether the differential effects of processing mode were due to the beneficial effects of concrete processing or the dysfunctional effects of abstract processing, it would be useful to include a no-training control group who are asked, for example, to watch the clips without trying to regulate or control their emotions. This could be followed with open-ended questions aimed to elicit what thoughts went through their mind when they were watching the films to ascertain if they were using any particular processing mode. Potential demand effects could be investigated by asking participants to what extent they thought their allocated processing mode would reduce their negative emotions in response to the clip and compare their expectations to observed responses (e.g. Holmes *et al.*, 2006).

It would be interesting to explore between-group differences in responses to intrusive memories, for example, whether the abstract group ruminated more or experienced more distress linked to their intrusive memories, since these are factors that have been linked to the maintenance of PTSD symptoms. Furthermore, given findings that women are at increased risk of developing PTSD than men, it would be interesting to explore potential gender differences in the effect of processing mode in response to analogue trauma and whether males have a greater tendency towards concrete processing.

The present findings could be strengthened by having a more objective manipulation check, indicating whether participants significantly differ on an objective measure of processing mode. This could involve, for example, recording thought samples from participants and having these rated by independent raters blind to condition, using a scale such as the Stöber and Borkovec (2002) abstract-concrete scale used by Watkins *et al.* (2008). This would give a more reliable

and objective manipulation check and would increase the likelihood of any differences in outcome being due to differences in processing mode. It would also be useful to obtain objective ratings of valence in the same way to assess whether groups' appraisals differed along this dimension as well.

It would be useful to see whether the current findings would extend to post-event processing, that is, whether training people to think about an analogue traumatic event afterwards in an abstract or concrete way would influence the development of intrusive memories. Ehring *et al.* (2009) failed to find a differential effect of post-event abstract or concrete processing on intrusive memories in response to analogue trauma. However, in studies of depression it has been shown that thinking about an induced failure afterwards in an abstract way leads to more intrusions about the failure compared to thinking about it in a concrete way (Watkins, 2004). Demonstrating that post-event processing mode is causally involved in the development of PTSD symptoms would have further clinical implications for individuals who are regularly exposed to traumatic events or early interventions for those that have experienced an isolated traumatic event. In addition, thinking about a traumatic event retrospectively may reduce the cognitive load on individuals during a trauma and constitute a more tractable skill (Schartau *et al.,* 2009). It has been suggested that such reappraisal training programmes could be administered as a low intensity intervention as part of a stepped care approach for those recently exposed to trauma and who have preliminary symptoms (Schartau *et al.*, 2009).

As well as establishing the replicability of the effect, future research should explore what factors mediate the effect of processing mode on intrusive memories in order to better understand the precise mechanism of effect. Potential mediating factors could include, for example, change in mood and level of construal (i.e. abstract versus concrete). Although mood was not significantly correlated with outcome, it would also be useful to explore what happens when affect is returned to baseline after training or when there is a longer gap between training and the final test clip.

If the present findings were replicated in non-clinical populations, it would be useful to then explore how well they generalise to occupational groups by developing and piloting a training programme for at-risk occupational groups such as ambulance workers.

4.6 Conclusion

This study supports the hypothesis that processing an analogue trauma in a concrete way leads to fewer intrusive memories than processing it in an abstract way. It also showed that concrete processing training led to reduced distress and horror elicited by a subsequent analogue trauma compared with abstract training, although this did not extend to subjective ratings of arousal of negative affect. Investigation of the relationship between predictor variables and intrusive memories revealed that self-reported proneness to intrusive memories in everyday life and sleep difficulties significantly predicted the number of intrusions developed in response to the traumatic films, although trait rumination and dissociation did not.

Findings are explained both in light of cognitive models of PTSD and transdiagnostic theories of processing mode, with common mechanisms being a concrete mode of processing enhancing a contextualised representation of the event and an abstract mode of processing fostering decontextualised representations, unhelpful generalisations and increasing distress. Consistent with cognitive models of PTSD (e.g. Brewin *et al.*, 1996; Ehlers & Clark, 2000), it is argued that concrete processing promotes the contextualisation of the trauma memory, facilitating the formation of a coherent narrative of the event. Abstract processing on the other hand, may prevent contextualisation and lead to a disjointed memory of the event as well as overgeneralised appraisals, two key processes which are hypothesised to cause distressing intrusive re-experiencing.

Although replication is needed, these findings have promising implications for developing training programmes for at-risk occupational groups aimed at reducing the development of PTSD symptoms following trauma. Future studies should include exploring replicability using tighter controls, examining mediating factors, investigating whether the effect can be extended to post-event processing and exploring generalisability to real-life settings.

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Appendix 1: Letter of ethical approval

Rachel White
Department of Psychology
PO 78
Institute of Psychiatry
Addiction Sciences Building
4 Windsor Walk
London
SE5 8AF

18 April 2011

Dear Rachel

PNM/10/11-55 The effect of processing mode on mood and intrusive memories after exposure to trauma: an experimental analogue study.

Thank you for sending in the amendments requested to the above project. I am pleased to inform you that these meet the requirements of the PNM RESC and therefore that full approval is now granted.

Please ensure that you follow all relevant guidance as laid out in the King's College London Guidelines on Good Practice in Academic Research (http://www.kcl.ac.uk/college/policyzone/index.php?id=247).

For your information ethical approval is granted until 18 April 2013. If you need approval beyond this point you will need to apply for an extension to approval at least two weeks prior to this explaining why the extension is needed, (please note however that a full re-application will not be necessary unless the protocol has changed). You should also note that if your approval is for one year, you will not be sent a reminder when it is due to lapse.

If you do not start the project within three months of this letter please contact the Research Ethics Office. Should you need to modify the project or request an extension to approval you will need approval for this and should follow the guidance relating to modifying approved applications: http://www.kcl.ac.uk/research/ethics/applicants/modifications.html

Any unforeseen ethical problems arising during the course of the project should be reported to the approving committee/panel. In the event of an untoward event or an adverse reaction a full report must be made to the Chairman of the approving committee/review panel within one week of the incident.

Please would you also note that we may, for the purposes of audit, contact you from time to time to ascertain the status of your research.

If you have any query about any aspect of this ethical approval, please contact your panel/committee administrator in the first instance (http://www.kcl.ac.uk/research/ethics/contacts.html). We wish you every success with this work.

With best wishes

Yours sincerely

Jim Summers

Research Ethics Team Leader

c.c.
Dr Patrick Smith
Jennifer Wild

Appendix 2: General Information Questionnaire

GENERAL INFORMATION QUESTIONNAIRE

Please give us some background information about yourself.

The following questions ask about you and your life in general. For each question, either write the answer on the line or tick the box which most applies to you. Some questions may have more than one answer.

1. Date of birth	_____/_____/_____	
2. Gender	❑ male ❑ female	
3. Ethnic background	❑ Caucasian (White) ❑ Pacific Asian ❑ Other _____	❑ Black (Caribbean, African, Other) ❑ Indian/Pakistani/Bangladeshi
4. Is English your first language?	❑ Yes ❑ No. Which is your first language? _____	
5. What is your marital status?	❑ single ❑ married	❑ divorced/separated ❑ widowed
6. Are you	❑ employed full-time ❑ employed part-time ❑ self-employed ❑ a homemaker ❑ on sick leave ❑ other: _____	❑ a full-time student ❑ a part-time student ❑ unemployed ❑ on disability ❑ retired
7. What is your job/ course? (If unemployed/ retired: What was your last job?)	_____	
8. At what age did you start/finish education?	start: _____	finish: _____

9. Please mark any qualifications you have.	❑ No exams _____	❑ Degree	❑ Other:
	❑ GCSE/O Levels/GNVQ	❑ Postgraduate degree: please circle: Masters / PhD / other:_____	
	❑ A Levels/NVQ	❑ Vocational degree	
10. Please try to estimate approximately what your annual household income.	❑ Less than £5000 per year ❑ £5000 to £10,000 per year ❑ £10,000 to 15,000 per year ❑ £15,000 to £20,000 per year	❑ £20,000 to £30,000 per year ❑ £30,000 to £40,000 per year ❑ £40,000 to £50,000 per year ❑ over £50,000 per year	
11. How often do you drive a car	❑ Everyday ❑ Once a week ❑ Twice a month ❑ Twice a year ❑ Never		

Appendix 3: Trauma Screener

Many people have lived through or witnessed a very stressful and traumatic event at some point in their lives. Indicate whether or not you have experienced each traumatic event listed below by marking **Y** for Yes or **N** for No.

				If YES, did you experience distressing unwanted memories of the event (flashbacks, nightmares, unwanted thoughts?)	
1.	Serious traffic accident, (e.g., car, bike, train, or boating accident)	Y	N	Y	N
2.	Serious other accident, fire, or explosion (for example, accident at work, fire at home)	Y	N	Y	N
3.	Natural disaster (for example, tornado, hurricane, flood, or major earthquake)	Y	N	Y	N
4.	Non-sexual assault (for example, being mugged**,** physically attacked, shot, stabbed, or held at gunpoint)	Y	N	Y	N
5.	Seriously injuring or killing someone else	Y	N	Y	N
6.	Sexual assault **(**for example, rape or attempted rape)	Y	N	Y	N
7.	Military combat or a war zone *Please indicate whether you were:* *civilian* _____ / *military personnel* _____	Y	N	Y	N
8.	Terrorist attack (e.g., bombing**)**	Y	N	Y	N
9.	Unwanted sexual contact when you were younger than 18 with someone who was 5 or more years older than you (for example, contact with genitals, breasts)	Y	N	Y	N
10.	Imprisonment (for example, prisoner of war, hostage)	Y	N	Y	N
11.	Torture	Y	N	Y	N
12.	Life-threatening illness	Y	N	Y	N
13.	Witnessing others die / being seriously hurt	Y	N	Y	N
14.	Sudden, traumatic death of significant other	Y	N	Y	N
15.	Life-threatening illness of significant other	Y	N	Y	N
16	Other traumatic event	Y	N	Y	N

Please specify:……..

……

……

Appendix 4: Proneness to intrusions scales

How often do you find that you have unwanted memories of unpleasant or stressful events popping into your mind, for example, after an exam, job interview or argument with somebody?

Not at all	Once a week or less	2-4 times per week	5 or more times per week	Everyday

How often do you find that after you have seen something unpleasant on the television or at the cinema, it comes back into your mind without you wanting it to?

Not at all	Once a week or less	2-4 times per week	5 or more times per week	Everyday

How often do you find that pleasant or happy events pop into your mind, for example, after a nice evening with friends or a film that you found funny?

Not at all	Once a week or less	2-4 times per week	5 or more times per week	Everyday

Appendix 5: Emotional reactivity scales

How did you feel during the film?

0	10	20	30	40	50	60	70	80	90	100
Extremely negative					Neutral					Extremely positive

How much distress did you experience during watching the film?

0	10	20	30	40	50	60	70	80	90	100
No distress										Extreme distress

How much horror did you experience whilst watching the film?

0	10	20	30	40	50	60	70	80	90	100
No horror										Extreme horror

How much arousal did you experience during the film?

0	10	20	30	40	50	60	70	80	90	100
No arousal										Extreme arousal

Appendix 6: Intrusions diary

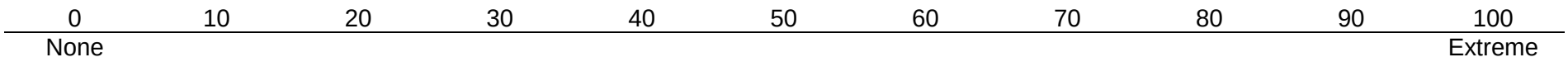
Participant no.: .....

Diary of intrusive memories post-experiment

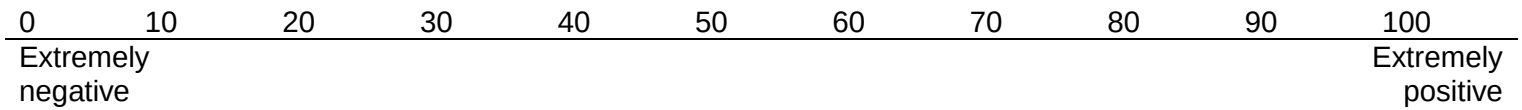
Days after experiment	**Please record how often you have had spontaneously occurring memories (intrusions) of any scenes that you saw during the film clips.**	For each one, please indicate if the intrusion was an image (I) or a thought (T) and what it referred to
DAY 1		
DAY 2		
DAY 3		
DAY 4		
DAY 5		
DAY 6		
DAY 7		

Appendix 7: Mood and personal relevance scales

How much personal relevance did this film have for you?



Please rate your current mood:



Appendix 8: Attention and compliance with instructions scales

Please rate along the following scale what percentage of the time you think you paid attention to the film

0	10	20	30	40	50	60	70	80	90	100
0% of the time										100% of the time

Please rate along the following scale what percentage of the time you think you watched the film in a particular way according to the instructions given to you

0	10	20	30	40	50	60	70	80	90	100
0% of the time										100% of the time

Appendix 9: Diary compliance scale

Please indicate to what extent you think you completed the diary reliably and accurately:

Not at all	Sometimes	Often	Most of the time	Always

Appendix 10: Recruitment email circular

Circular email for use for recruitment of volunteers for study ref: PNM/10/11-55, approved by the Psychiatry, Nursing and Midwifery Research Ethics Sub-Committee (PNM RESC). This project contributes to the College's role in conducting research, and teaching research methods. You are under no obligation to reply to this email, however if you choose to, participation in this research is voluntary and you may withdraw at any time.

You are invited to take part in a research study which investigates factors linked to people's responses to trauma. It is hoped that the results of this study will eventually help us to develop a prevention programme for people who are regularly exposed to trauma such as emergency service workers and military personnel. You will be paid £15 as compensation for your time if you take part.

We are recruiting people over the age of 18 who are fully fluent in English, are not currently experiencing depression or anxiety and who do not have current symptoms of post-traumatic stress disorder. Unfortunately, you will be unable to take part if you have participated in (or are due to participate in) studies by our colleagues Kristen Warnock, Khodayar Shahriyarmolki or Juliane Sachschal.

Participating in this study will involve attending a session that lasts for approximately 1 hour 15 minutes, completing a simple diary over the following week and then completing an online questionnaire and submitting the diary a week later. During the session, you will be asked to fill in a series of questionnaires. You will then be shown a series of short film clips that contain traumatic material (e.g. humans and animals in distress) and will be asked to watch them in a certain way according to instructions that you will be given. You will also be asked to fill in some brief questionnaires in relation to the films. Sessions will take place at the Institute of Psychiatry in Denmark Hill.

Your participation is entirely voluntary and if you decide to take part but later wish to withdraw, you may do so at any time without giving a reason. All information will be anonymised and kept confidential.

If you are interested in taking part in this study or would like more information then please email Rachel.White@kcl.ac.uk. You will be given an information sheet with further details.

Kind regards,

Rachel White
Trainee Clinical Psychologist

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Denmark Hill
London SE5 8AF

Appendix 11: Participant information sheet

INFORMATION SHEET FOR PARTICIPANTS

REC Reference Number: PNM/10/11-55

YOU WILL BE GIVEN A COPY OF THIS INFORMATION SHEET

What influences reactions to trauma? A an experimental study

We would like to invite you to participate in this Doctorate in Clinical Psychology research project. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information.

What is the purpose of this study?

This study aims to investigate what factors may influence emotional responses to traumatic films to inform a larger research study. Understanding these factors could help to inform the development of prevention programmes for people who are regularly exposed to trauma such as emergency service workers and military personnel, and who are at risk of developing Post Traumatic Stress Disorder (PTSD), a severe stress reaction that develops after traumatic events such as violence, road traffic accidents, terrorist bombings and natural disasters.

Are you eligible?

You will be invited to take part if you are over the age of 18 and if the first three questionnaires you complete suggest that you have few signs of depression, anxiety or PTSD. You will not be able to take part if, on any of these three questionnaires, you score above a certain mark, which suggests that you may have depression, anxiety or PTSD. If this is the case, the researcher will chat with you and give you suggestions about what may be helpful, which could be a visit to your GP. These screening questionnaires will be destroyed after use.

What will taking part involve?

Participating in this study will involve attending a session which will last for approximately one hour, completing a simple diary over the following week and then submitting the diary (by post) and completing an online questionnaire a week later, after which you will receive a payment of £15 as compensation for your time. During the first session, you will be asked to fill in a series of questionnaires. You will then be asked to watch a series of film clips that contain traumatic material (e.g. road traffic accidents, humans and animals in distress) and will be instructed to watch them in a certain way according to instructions that you will be given. You will also be asked to fill in some brief questionnaires in relation to the films.

What are the possible disadvantages or risks of taking part?

As this study involves watching films that contain traumatic material, there is a risk that some people may become distressed. Furthermore, some of the questionnaires ask about sensitive topics, which some participants could find distressing. However, studies of a similar nature have been conducted before without adverse consequences and any distress that you experience is likely to be short-lived. You are free to withdraw at any time, without giving a reason, and in the unlikely event that you become distressed, the session would be stopped immediately. You would be given the option to talk to the researcher, who is a trainee clinical psychologist. You would also be given the opportunity to talk to the researcher's

supervisor, who is a Consultant Clinical Psychologist who also is available during the testing sessions if needed.

What are the possible benefits of taking part?

If you take part you will have the option of receiving a summary of the research findings. Taking part will also give you the opportunity to be involved in research which seeks to promote a greater understanding of responses to trauma and inform preventative interventions for people who are regularly exposed to it.

Will my taking part in the study be kept confidential?

All information and data collected will be anonymised and confidential in accordance with the Data Protection Act (1998). You will be randomly allocated a unique code, which will be recorded on questionnaires and used in data analysis so that you cannot be identified from the data. Anything containing personally identifiable information, such as signed consent forms, will be kept separately from the data in a locked filing cabinet and only the immediate research team (which includes the researcher and her two supervisors) will have access to it. Electronic data will be kept on a secure database on a password accessible computer and any paper forms will be kept in a locked filing cabinet. All personally identifiable information will be kept confidential. The only circumstances under which confidentiality cannot be maintained is if you indicated potential risk of harm to yourself or other people.

So what do I do if I want to take part?

If you would like to take part in this study or if you have a general query about it, then please contact the researcher, Rachel White, at the Department of Psychology, Institute of Psychiatry, Addiction Sciences Building, 4 Windsor Walk, London, SE5 8AF, email: Rachel.White@kcl.ac.uk, tel: 0207 848 0223.

It is up to you to decide whether to take part or not. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. You will also be able to withdraw your data up until 31st December 2011.

If this study has harmed you in any way you can contact King's College London using the details below for further advice and information:

> Dr Jennifer Wild (Research Clinical Psychologist, Honorary Consultant Clinical Psychologist and Senior Lecturer) - Institute of Psychiatry, PO Box 77, De Crespigny Park, London, SE5 8AF, email: Jennifer.Wild@kcl.ac.uk, tel: 0207 848 5045

Appendix 12: Consent form

CONSENT FORM FOR PARTICIPANTS IN RESEARCH STUDIES

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the research.

Title of Study: _____

King's College Research Ethics Committee Ref:_____

Thank you for considering taking part in this research. The person organising the research must explain the project to you before you agree to take part. If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you decide whether to join in. You will be given a copy of this Consent Form to keep and refer to at any time.

Please tick or initial

- I understand that if I decide at any time during the research that I no longer wish to participate in this project, I can notify the researchers involved and withdraw from it immediately without giving any reason. Furthermore, I understand that I will be able to withdraw my data up to the point of publication. ☐
- I consent to the processing of my personal information for the purposes explained to me. I understand that such information will be handled in accordance with the terms of the Data Protection Act 1998. ☐
- I agree that the research team may use my data for future research and understand that any such use of identifiable data would be reviewed and approved by a research ethics committee. (In such cases, as with this project, data would not be identifiable in any report). ☐

The information you have submitted will be published as a report and you will be sent a copy. Please note that confidentiality and anonymity will be maintained and it will not be possible to identify you from any publications.

Participant's Statement:

I _____

agree that the research project named above has been explained to me to my satisfaction and I agree to take part in the study. I have read both the notes written above and the Information Sheet about the project, and understand what the research study involves.

Signed Date

Investigator's Statement:
I _____
Confirm that I have carefully explained the nature, demands and any foreseeable risks (where applicable) of the proposed research to the participant.

Signed Date

Service Evaluation Project

An Audit of the Demographic and Clinical Characteristics of Children and Adolescents Referred to a National and Specialist Autism and Related Disorders Team over a Three-year Period

Supervisor: Dr Janne Karpf

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Abstract

The present audit sought to examine the demographic and clinical characteristics of children and adolescents referred to the Autism and Related Disorders (ARD) team and to investigate change in these factors over a three-year period. Monitoring such characteristics is important in enabling the service to understand and adapt to the needs of the population it serves. It was hypothesised that there would be an increase in overall clinical complexity (characterised by increased age, psychiatric and medical comorbidity, clinical severity, risk and service need) over the three-year period. Such an increase would suggest an improvement in local services' skills in diagnosing and managing less clinically complex cases, resulting in an increasing number of children with more complex clinical presentations who are more difficult to diagnose and treat being referred. A retrospective case note review was carried out of a three-year time period between July 2007 and July 2010. Results showed that most of the sample was White-British and male, with an average age of 11.5 years. Over three years, there was an increase in the frequency of older children (i.e. secondary school age) being referred. Most were national referrals although the rate of local referrals increased over time. Overall, the sample was clinically complex, with high levels of medical and psychiatric comorbidity, additional (e.g. educational and social) needs and a moderate level of clinical severity. Clinical comorbidity was related to the age of the child; older children were more likely to receive comorbid diagnoses of depression and anxiety disorders, whereas younger children were more likely to receive diagnoses of hyperkinetic disorder, oppositional or conduct disorder and enuresis or encopresis. Fewer children with learning disabilities were seen in the later time period, suggesting that an increasing number of cognitively high-functioning children were being referred. No change was seen in a measure of overall clinical complexity of cases over time, although limitations to the operationalisation of complexity are considered. Implications of the audit are discussed in relation to meeting the needs of the increasingly older children being referred, providing support with transition into adulthood and supporting local services in identifying and managing less complex cases.

1. Introduction

1.1 Autism spectrum disorder

Autism spectrum disorder (ASD) is a developmental disorder characterised by a triad of impairments, including: i) qualitative impairments in communication; ii) impairments in social interaction; and iii) restricted and repetitive patterns of interest and behaviour. ASD causes considerable distress to individuals and families and interferes with the individual's ability to function effectively in society. This can lead to social and economic exclusion and development of additional difficulties. ASD poses a considerable economic burden in the UK, with the annual cost estimated at over £1 billion, including costs of education, health, social services and other agencies (Järbrink & Knapp, 2001).

The term 'early infantile autism' was first coined by Leo Kanner in 1943 to describe children with severe impairments in social interaction and communication, and an intense resistance to change, often associated with intellectual disability. Towards the later part of the 20th Century, the term autism spectrum disorder was developed (Wing & Gould, 1979). This reflected the growing recognition that symptoms could manifest differently between individuals and at differently levels of severity, ranging from subtle features to obvious impairments. It was also increasingly observed that ASD occurred in individuals of all intellectual and linguistic levels (Howlin, 2010; Wing & Potter, 2002). These changes in the conceptualisation of ASD were reflected in the ICD-10 (WHO, 1992) and DSM-IV (APA, 1994), in which subtypes of ASD are collectively referred to as 'pervasive developmental disorders' (PDD). Types of PDD include childhood autism, atypical autism, Asperger's syndrome, other pervasive developmental disorder, pervasive developmental disorder unspecified and childhood disintegrative disorder.

1.2 Prevalence of ASD

Historically, autism was considered to be a rare condition, with prevalence rates estimated at four to five cases per 10,000 for 'pure' autism and 20 per 10,000 for children showing the triad of impairments described by Wing and Gould (1979). Since the 1990s however, prevalence estimates have increased. Baird *et al.* (2006) reported a prevalence of 38.9 per 10,000 for

childhood autism in the South Thames region and 116.1 per 10,000 for ASD. ASD occurs more commonly among males than females, with a ratio of approximately 4:1, extending to 9:1 when the narrower, historical definition is used (Fombonne, 2005; 2009). Although it is possible that an increase in prevalence estimates reflects a true rise in cases of ASD, evidence suggests that the majority of the increase is due to a broadening of diagnostic criteria (encompassing differences in presentation and severity) as well as an increasing awareness and recognition of ASD among parents, professionals and the general public (Wing & Potter, 2002).

1.3 Aetiology

The aetiology of ASD is multifactorial, consistent with the heterogeneity of the disorder, and much is yet to be understood about its genetic and non-genetic causes (Rutter, 2005). The strongest evidence is for genetic factors, with data from twin studies showing a heritability rate of 90% (Rutter, 2005). There is also evidence that the broader phenotype of ASD (i.e. more subtle impairments in communication and social interaction and stereotyped behaviours) occurs in up to 20% of first degree relatives of children with ASD (Bolton *et al.*, 1994). The role of genetic factors is complex, with multiple susceptibility genes involved. Non-genetic factors may also play a role, although as yet evidence is inconclusive about what these factors are (Rutter, 2005). Possible influences include pre-natal infections and toxins (e.g. hypothyroidism, use of thalidomide and other drugs) and congenital rubella. There has been no evidence supporting any aetiological role for immunisations such as the MMR vaccination (Rutter, 2005).

1.4 Clinical complexity and comorbidity

The spectrum concept was accompanied by a growing awareness that, rather than being a ‘stand-alone’ disorder, ASD frequently co-occurs with other developmental, physical or psychiatric disorders. In fact, comorbidity is now considered to be the ‘rule’ rather than the exception in ASD and to be expected whenever a diagnosis is made (Gillberg & Billstedt, 2000). Other difficulties such as sleep problems, abnormal sensory responses and difficulties with attention and hyperactivity, also cause difficulties for individual and families, yet are not part of the ASD diagnostic criteria and may not meet criteria for a separate disorder (Gillberg & Billstedt, 2000).

Medical conditions commonly associated with ASD can be divided into non-specific and specific conditions (Gillberg & Billstedt, 2000). Non-specific conditions include learning disability (ranging from 25.8 to 71.3% children with ASD; O'Brien & Pearson, 2004), epilepsy, speech and language difficulties, motor problems and hearing and visual impairments. Specific medical conditions (present in approximately 10-25% cases; Gillberg & Billstedt, 2000) include some 50 different disorders, including genetically determined disorders such as tuberous sclerosis and fragile X syndrome.

Studies consistently show that individuals with autism are at increased risk for psychiatric disorders than their normally developing peers (Gillberg & Billstedt, 2000; Kim *et al.,* 2000). Ghaziuddin (2002) highlighted that referrals for assessment of ASD are often prompted these additional difficulties, which can cause increased disruption in functioning and be of greater concern to families than autistic symptoms themselves (Loveland & Tunali-Kotoski, 1997). Ghaziuddin *et al.* (1998) found an overall psychiatric comorbidity rate of 65% among children and adolescents with Asperger's syndrome. In a large representative population sample of children with ASD using standardised interview measures based on DSM-IV criteria (Simonoff *et al.*, 2008) found a psychiatric comorbidity rate of 70.8%. Of these, 41.9% met criteria for an anxiety disorder, 30% for oppositional defiant or conduct disorder, 28.3% for attention deficit hyperactivity disorder (ADHD; known as hyperkinetic disorder in ICD-10), 4.8% for Tourette's syndrome and 9% for tic disorders. Only 1.4% of their sample met criteria for depression, although higher rates have been found in other studies. For example, Kim *et al.* (2000) found a prevalence rate of 17% among individuals with ASD and Ghaziuddin *et al.* (1998) found a rate of 37% among those with Asperger's syndrome. The types of difficulties associated with ASD may vary according to the age and developmental level of the child. Ghaziuddin *et al.* (1998) found that ADHD presented more frequently in younger children whereas adolescents tended to have higher rates of depression. Sukhodolsky *et al.* (2008) found that anxiety was associated with higher IQ and functional language use.

Comorbid emotional difficulties such as anxiety and depression may be a direct consequence ASD, for example, as a result of underlying biological vulnerabilities (Abramson *et al.*, 1992; Piven & Palmer, 1999) or impairments with cognition (particularly executive functioning) and self-regulation (Loveland & Tunali-Kotoski, 1997). However, they may also be an indirect consequence, particularly among older and higher-functioning children, resulting from an increased awareness of interpersonal differences and facing an increasingly complex social milieu as they approach adolescence and begin secondary school (White *et al.*, 2009).

1.5 Assessment of ASD

Early diagnosis of ASD is important in helping families come to terms with the diagnosis and to ensure that, from an early age, appropriate support is given. Failure to diagnose ASD can result in inappropriate educational provision, inappropriate interventions for comorbid difficulties (e.g. that fail to take into account cognitive and linguistic limitations) and inappropriate expectations of the child. Assessment should entail a detailed developmental history, observation of behaviour in structured and unstructured settings, assessments of cognition and language, and specialist diagnostic instruments such as the Autism Diagnostic Interview (ADI; Lord *et al.*, 1994), Autism Diagnostic Observation Schedule (ADOS; Lord *et al.*, 2000) or Diagnostic Interview for Social and Communication Disorders (DISCO; Wing *et al.*, 2002). Specialist ASD questionnaires or tests may be used (e.g. Social Communication Questionnaire, Rutter *et al.* 2003; Reading Mind in the Eyes test; Baron-Cohen *et al.*, 1997; Strange Stories test; Happé, 1994). Assessments should be carried out by a multi-disciplinary team and take place over different times and settings (Chowdhury, 2009; Howlin, 2010). These should be supplemented by medical investigations such as hearing and vision tests, and genetic testing where indicated (Chowdhury, 2009).

As well as establishing whether or not the child meets criteria for ASD, assessment should consider other potential diagnoses that may resemble ASD such as hyperkinetic disorder (ADHD) or conduct disorder. Understanding and treating additional difficulties is important, as delivering interventions for additional disorders without taking into account ASD and vice versa is likely to impede treatment progress. Detecting or differentiating other diagnoses from ASD is complex however, as symptoms such as anxiety and depression may present differently in children who have difficulties identifying and communicating their own feelings (Loveland & Tunali-Kotoski, 1997). Nevertheless, it is important that additional difficulties (e.g. aggressive behaviour, hyperactivity, anxiety and depression) are understood and treated, as this can positively impact on overall quality of life and long-term outcome (Ghaziuddin, 2002).

1.6 Treatment of ASD

There is no ‘cure’ for autism. Instead, interventions focus on improving functioning by targeting core deficits and working with children and families to learn skills to compensate for

these impairments. A vast number of interventions have been developed, which can be divided into those that are behaviour-based, communication-based and those that focus on improving social and emotional competence and understanding (Howlin, 2010). Psychological interventions are also needed to treat comorbid difficulties (e.g. anxiety and depression) and may be adapted to accommodate difficulties individuals with ASD may face in psychological therapy.

At present, there is no evidence that one intervention for ASD is superior to others. It is also evident that there are large individual differences in response to these interventions, therefore emphasis is gradually shifting from 'what works best' to finding out which interventions work better for which children and under which circumstances (Howlin, 2010). As well needs varying between individuals, they may also vary over time and there is a need for services which monitor and adapt to these changing needs over the years (Howlin, 2010).

1.7 Autism and transition to adulthood

Autism is a lifelong condition and adulthood poses additional challenges in terms of employment, relationships, housing and independence. In recent years, outcomes for adults with autism have improved (e.g. in employment, independent living and meaningful social relationships), reflecting better education and therapy provision (Howlin, 1997). However, many adults with autism still rely heavily on others for support and, compared with children and adolescents, support for adults with ASD is lacking (Howlin *et al.*, 2004). This means that when adolescents with autism reach eighteen, they risk 'slipping through the net', being discharged from services without being picked up by an appropriate service.

The Autism Act 2009 was developed with the aim of improving outcome and quality of life for adults with autism. This led to the development of the Autism Strategy (Department of Health, 2010) which outlines plans to increase understanding and awareness of the condition, improve recognition and diagnosis in adults and promote greater opportunities for adults with autism to live fulfilling and rewarding lives. One of the objectives of the strategy is to plan for the provision of services to support people with ASD in the transition from adolescence to adulthood and support to access independent living and employment.

1.8 Summary

In recent years, there has been a growing awareness of the prevalence and complexity of ASD. As well as an increased understanding of the wide variation in manifestation and severity of symptoms, there is a growing recognition of the additional difficulties faced by individuals (e.g. high rates of comorbid medical and psychiatric conditions and social difficulties), which contribute to complexity. Early diagnosis is crucial in order to help families come to terms with diagnosis, for appropriate support to be put in place early on and to minimise the impact of ASD on the individual's functioning. Diagnosis is a complex process, particularly where difficulties are not clear cut or where comorbidities are present. There is a corresponding need for specialist services with expertise in ASD and related difficulties to carry out assessment and treatment of more complex cases. Services also need to recognise individual variation over time, and to ensure that support is continued during the potentially problematic transition from adolescence to adulthood.

2. The Autism and Related Disorders team

The Autism and Related Disorders (ARD) team is a National Specialist Child and Adolescent Service, based at the Michael Rutter Centre in South East London, part of South London and Maudsley (SLaM) NHS Foundation Trust. The service receives referrals from across the UK and offers multidisciplinary assessment and management of complex cases of ASD. This includes where there are complex diagnostic issues, additional medical or psychiatric difficulties or when a second opinion is being sought. The team also offers consultation to other services, genetic counselling, treatment and support and advice to families, including parenting support.

A team intake day occurs each week when a new case is seen for assessment. Prior to assessment, an intake summary is compiled outlining details of the referral and information from self-report measures that are sent out before the assessment, including the Social Communication Questionnaire, Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), Developmental and Well-being Assessment (DAWBA; Goodman *et al.*, 2000) and the Conners' Rating Scales-Revised (Conners, 2004). As well as providing further information about the child's social communication difficulties, these additional measures highlight

potential differential diagnoses. The Autism Diagnostic Interview is typically carried out with caregivers prior to the team intake day.

On the intake day, the multidisciplinary team meets with the family to gather information and expectations from the day, after which the psychiatrist obtains a developmental history from caregiver(s). A clinical psychologist meets with the child separately, usually to carry out a cognitive assessment, along with a psychological assessment interview and other relevant psychometric measures where indicated. The Autism Diagnostic Observation Schedule is carried out in the second half of the day, which is a standardised assessment protocol for assessing social communication. It involves a series of structured and semi-structured tasks which aim to elicit social interaction between the individual and the examiner. The qualities of target behaviours are then rated by the team to form a consensus score. At the end of the day, the multidisciplinary team meets to discuss formulation and diagnosis before meeting with the family to give feedback and recommendations, which may include further assessment or intervention.

Further assessment may involve school or home visits, further neuropsychological assessment or medical investigations such as cytogenetic testing. Interventions may include psychoeducation, medication, CBT, social skills training, behavioural interventions, specialist educational advice, parenting interventions, behavioural management advice to schools and families, educational advice or consultation and advice to referring agencies. A parenting group is run twice a year. Further assessment or intervention may be carried out by the ARD service or may be recommended for local services.

2.1 Aims and hypotheses

The ARD service strives to continually evolve to meet the needs of its clients in terms of assessment and treatment. By understanding and monitoring the demographic, clinical and service characteristics, it is hoped that the service will be better equipped to adapt to meet the needs of this population and their families. It also allows recommendations to be made for ways in which the service may be improved. The primary aim of this audit was therefore to establish the demographic and clinical characteristics of children and adolescents referred to the ARD team over a three-year period, as well as information about service provision.

As a national and specialist service, it is important that local services are equipped to diagnose and manage more straightforward cases and that the ARD team can dedicate time and resources to the most complex cases. A secondary aim was therefore to explore change in these characteristics over a three-year period, in particular looking at clinical complexity. An increased complexity of referred cases would suggest that local services were more skilled at diagnosing more 'straightforward' cases and increasingly only referring more complex cases. It also may reflect an increasing unwillingness of local services to refer to costly tier four services due to funding restrictions, unless such cases are particularly complex.

It was hypothesised that population would be clinically complex, with high rates of comorbidity and additional needs (e.g. social difficulties). It was also hypothesised that complexity would have increased over time, suggesting an improvement in local services' skills in diagnosing and treating less complex cases and/or an unwillingness to refer due to funding restrictions, and consequently increasingly referring more complex cases. This may also be reflected in an increase in national referrals, which was expected to increase.

3. Method

3.1 Data collection and participants

A retrospective case note review was carried out on 110 consecutive referrals to the service over a three-year period between July 2007 and July 2010. An additional 22 cases from this audit period were excluded due to the majority of data being missing (e.g. the family did not attend, the referral was a brief follow-up; $N = 10$) or files not being available ($N = 12$). Data were collected from paper files and the electronic Patient Journey System (ePJS). They were recorded initially by hand using a data collection pro forma (See Appendix) and subsequently entered into an SPSS database for analysis. To ensure anonymity of the data, a unique, randomly generated identification number was allocated to each participant, which appeared on the data collection pro forma and database. A separate key sheet containing corresponding identifying details (e.g. name, date of birth) was stored securely and only accessible by the researchers. Approval to carry out the audit was granted by the South London and Maudsley Child and Adolescent Mental Health Service Clinical Governance office.

3.2 Measures

An overview of data collected from case notes is provided in Table 1. Referral information was derived from correspondence prior to assessment. Clinical and service characteristics were derived from the medical assessment and ADI reports. Family history of ASD was indexed by the mention of ASD diagnosis or traits in family members. Level of risk was attained using the SLaM risk assessment questionnaire and operationalised as the number of areas (out of six) in which risk was assessed to be 'medium' or higher. Clinical severity was assessed using the Children's Global Assessment Scale (CGAS; Shaffer *et al.*, 1983), a reliable and valid measure of overall severity of disturbance. Scores range from 1 (most functionally impaired) to 100 (healthiest), with scores above 70 signifying normal functioning.

List of variables measured
Demographics • Gender • Age at assessment • Ethnicity • Referral pathways (who, where from, why) Clinical characteristics • Multi-axial diagnostic profile (using ICD-10 criteria) • Clinical severity measured by Childhood Global Assessment Scale (CGAS) • Age at which first concerns noted • Developmental milestones (presence of overall developmental delay, language delay or regression/loss of skills) • Family history of ASD • Involvement of Social Services and Youth Offending Team (YOT) • History of psychological treatment • Level of risk • Overall clinical complexity composite score Service related issues • Mean waiting time for assessment • Number of professionals involved in assessment • Assessments used • Treatment recommended or offered

Table 1. Overview of data collected from case note reviews.

Overall clinical complexity was operationalised by computing a complexity composite score for each case. This was done by selecting 11 variables believed to be indicative of complexity (e.g. comorbidity or additional service involvement) and calculating how many complexity indicators were present for each (Table 2). Scores were coded as 1 if the complexity indicator was present and 0 if absent. Overall complexity scores were then computed by adding the total number of complexity indicators for each case, which ranged from 0 to 11, with higher scores indicating a higher level of clinical complexity.

Composite measure of complexity
Psychiatric comorbidity (more than one diagnosis on axis 1)
Having a specific learning difficulty (axis 2)
Having a learning disability (axis 3)
Having a medical condition (axis 4)
Presence of issues in the social environment (axis 5)
Having a CGAS score below 50 (indicating higher severity)
Scoring ‘medium’ or higher in 3 or more areas on the SLaM risk assessment
Involvement of Social Services
Involvement of police, YOT or forensic services
Having a Statement of Special Educational Need
Previous psychological treatment

Table 2. Variables that comprised the composite measure of complexity.

3.3 Analysis

Descriptive statistics were obtained for the whole sample (*N* = 110), including demographic and referral information, complexity of clinical presentation and service-related issues. Subgroup analyses were conducted to explore differences in particular variables between gender, whether or not the child had a PDD diagnosis and change over time. To explore change over time, a 'time point' variable was created by selecting the first and last 30 cases and coding them as either 'early' or 'late'. The early group represented referrals made between January 2007 and June 2008 and the late group were referrals made between July 2009 and May 2010. Descriptive data were obtained and compared between groups and statistical analyses of difference were performed. For categorical data, cross-tabulations using Pearson's chi-square were conducted. Change in ordinal data over time was analysed using either t-tests or Mann-Whitney U tests, depending on whether or not the data were parametric. Spearman's rho correlational analyses were carried out to explore the relationship between age and diagnosis.

4. Results

For each stage of this section, descriptive statistics are presented for the whole sample and then for subgroup analyses (time, gender, PDD versus no PDD). Change over time was investigated for all variables. To explore potential gender differences, males and females were compared on age, diagnostic profile, other indicators of complexity and overall complexity. Those who received diagnoses of PDD were compared to those who did not on variables including diagnostic profile, family history of ASD and overall complexity.

4.1 Demographic information

4.1.1 Gender

Of the whole sample (N = 110) The majority of children and adolescents were male (86/100; 78%), with a male to female ratio of approximately 4:1. No change in the ratio of males to females was observed over time, $\chi^2(1) = .111$, $p = .500$.

4.1.2 Ethnicity

The majority of the sample was White-British (76%), with 24% belonging to other ethnic groups. It is noted that a higher proportion of non-White-British children were referred in the later time period (Figures 1 and 2), although this increase was not statistically significant, $\chi^2(1) = 1.27$, $p = .218$.

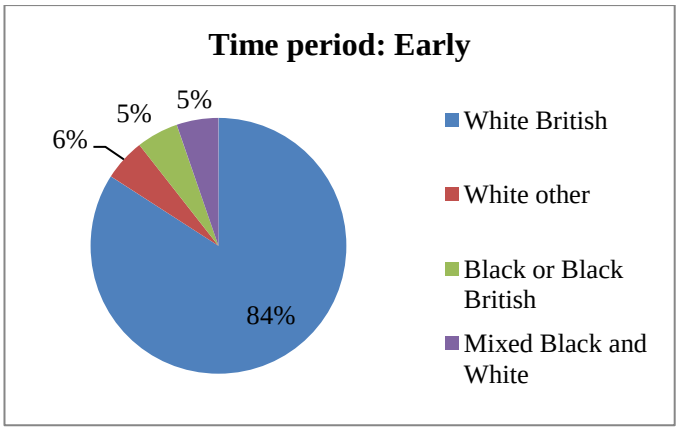

Figure 1. Ethnicities of children and adolescents referred during the early time period (Jan '07-June'08; N = 30).

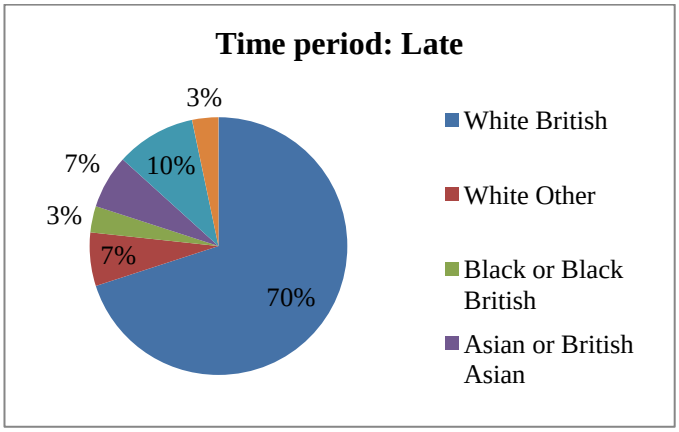

Figure 2. Ethnicities of children and adolescents referred during the later time period (July '09-May '10; *N* = 30).

4.1.3 Age at assessment

The mean age at assessment was 11.5 years (SD = 3.63), with no difference between males and females, $t(101) = .054$, $p = .957$. Participants were significantly older in the later time period, with the mean age increasing from 10.9 (SD = 3.7) to 12.8 years (SD = 3.6), $t(58) = -2.07$, $p = .043$. A chi-squared analysis also showed that there was a higher number of secondary school age children (>10 years) in the late group than in the early group and a smaller number of primary school age children (≤10 years), $\chi^2(1) = 4.8$, $p = .028$, which is illustrated in Figure 3.

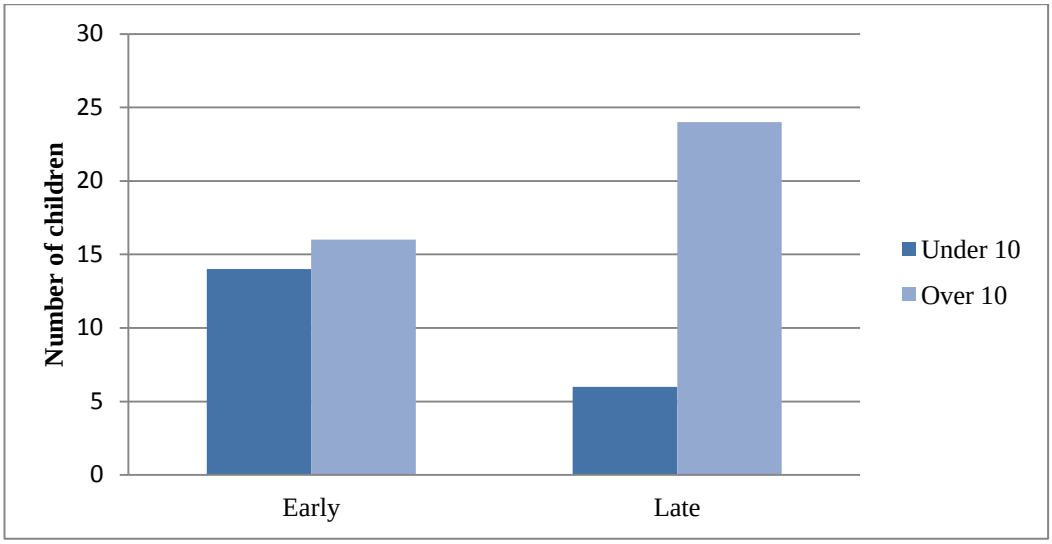

Figure 3. Comparison of children under and over ten years old referred to the service over two time periods (Jan '07-June '08 and July '09-May '10).

4.1.4 Referrals

Table 3 presents an overview of referral pathways to the clinic, including reason for referral, source of referral and referral region. Referrals were most frequently made by a child and adolescent psychiatrist (48.1%) for an assessment of possible ASD (76.6%). The majority of referrals were national referrals (62.9%), predominantly coming from other parts of London and the South East.

	Whole sample	**Early (Jan '07-June'08)**	**Late (Jul '09-May '10)**
Referral source	*N* = 106	*N* = 30	*N* = 30
• Consultant psychiatrist	48.1%	56.7%	53.3%
• Paediatrician	23.6%	26.7%	16.7%
• Psychologist	9.4%	3.3%	20%
• Other	18.8%	13.3%	10%
Referral region	*N* = 105	*N* = 30	*N* = 30
• Local (SLaM)	37.1%	16.7%	56.7%
• National (non-SLaM)	62.9%	83.3%	43.3%
o London	25.7%	30%	26.7%
o South East	26.7%	33.3%	13.3%
o Other national	10.5%	20%	3.3%
Reason for referral	*N* = 107	*N* = 30	*N* = 30
• ASD assessment	76.6%	70%	90%
• Treatment/advice	13.1%	10%	10%
• Review	10.3%	20%	0%

Table 3. Referral pathways to the clinic for whole sample and comparison of early and late time periods.

Figures 4 and 5 compare referral regions across time, and illustrate a significant increase in local (from SLaM) compared with national (non-SLaM) referrals across the three-year period. There were significantly more local referrals in later period and fewer national referrals, $\chi^2(1) = 10.34$, $p = .001$.

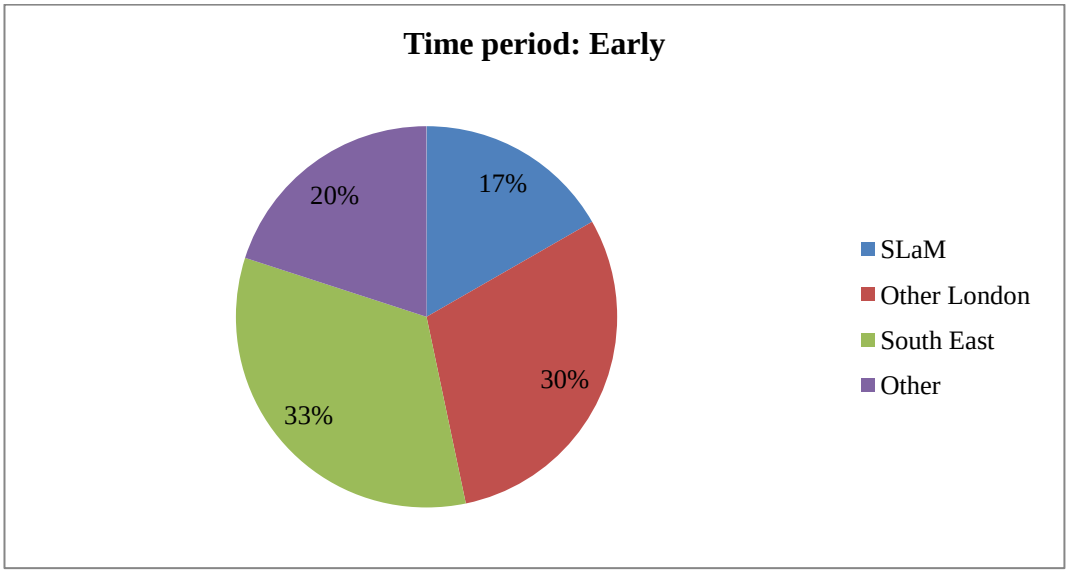

Figure 4. Referral regions for the early time period (Jan '07-June '08; *N* = 30).

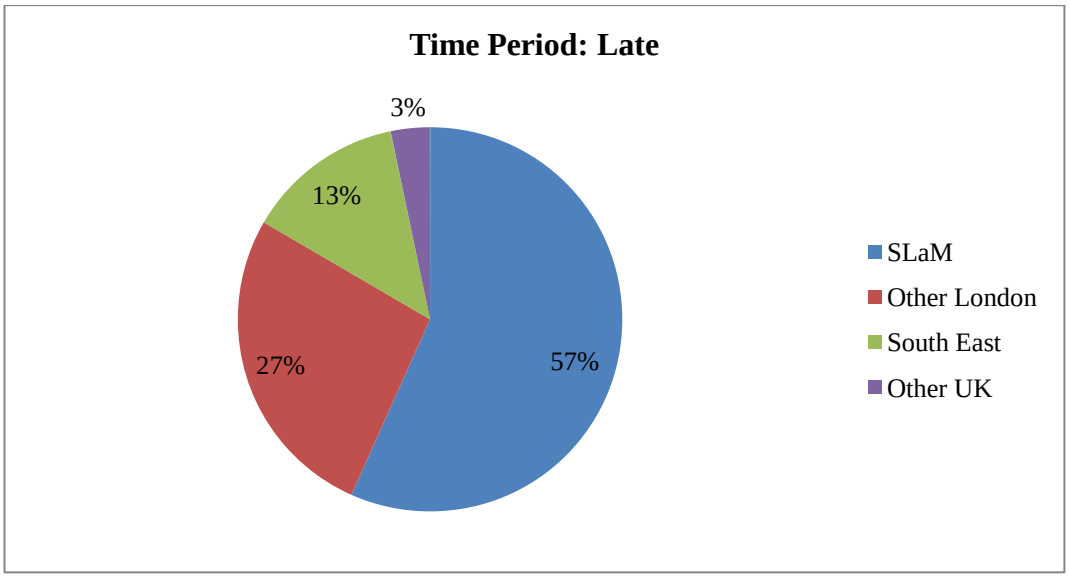

Figure 5. Referral regions for the late time period (July '09-Apr '10; *N* = 30).

4.1.5 Summary of demographic and referral information

The majority of children and adolescents referred to the clinic were White-British males. The mean was age eleven and a half, although children tended to be older in the later time period. Most were national referrals, although the proportion of national referrals decreased over time.

4.2 Clinical Characteristics

4.2.1 Diagnostic profiles and comorbidity: whole sample

Table 4 provides an overview of the multi-axial diagnostic profile of children and adolescents. It shows a high level of comorbidity, with 67.3% of the sample having more than one axis one diagnosis and the mean number of axis one diagnoses being 2.14 (SD = 1.23). Nearly three quarters (72.9%) of the sample met criteria for a pervasive developmental disorder. Of the whole sample, 37.1% had a specific disorder of psychological development (e.g. specific language or motor disorder) and 18.1% had a learning disability. There was a high rate of medical comorbidity (with a range of disorders such as epilepsy, tuberous sclerosis, macrocephaly, hearing impairment, Down's syndrome, diabetes), and a very high proportion (86.7%) of children had issues present in their social environment (e.g. anomalous parenting, intrafamilial discord, family mental health or developmental problems, bullying). The mean CGAS score was 47.6 (SD = 9.7), which falls under 'moderate degree of interference in functioning in most social areas or severe impairment in functioning in one area' (Shaffer *et al.*, 1983).

Multi-axial diagnostic profile	**Whole sample (*N* = 107)**
Axis 1	
• Mean number of diagnoses	2.14 (SD = 1.23; *N* = 104)
• Met criteria for PDD	78/107 (72.9%)
• Percentage with comorbidity	66/98 (67.3%)
Axis 2 (Specific disorder of psychological development)	39/105 (37.1%)
Axis 3 (Learning disability)	19/105 (18.1%)
Axis 4 (Medical condition	60/105 (57.1%)
Axis 5 (Issues in social environment)	91/105 (86.7%)
Mean CGAS score	47.6 (SD = 9.7; *N* = 86)

Table 4. Multi-axial diagnostic profile for whole sample.

Figure 6 shows the breakdown of PDD diagnoses for the whole sample. The most frequently made PDD diagnosis was 'other pervasive developmental disorder' (38%), followed by childhood autism (21%), Asperger's syndrome (18%), pervasive developmental disorder unspecified (13%), atypical autism (9%) and childhood disintegrative disorder (1%).

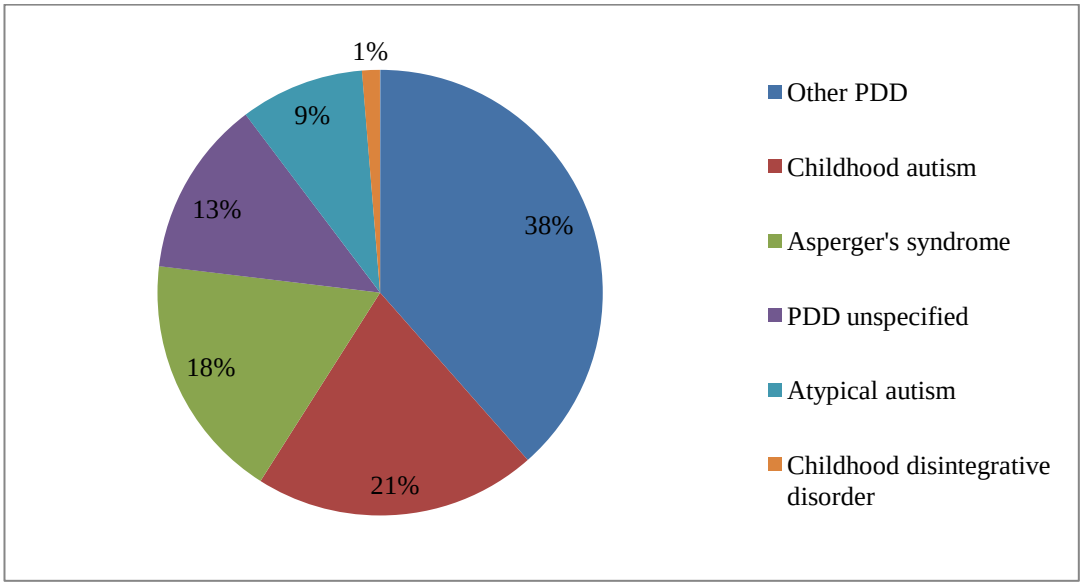

Figure 6. Distribution of PDD diagnoses for whole sample (*N* = 78).

Figure 7 shows the distribution of axis one diagnoses for the whole sample. The most common diagnoses aside from PDD were hyperkinetic disorder (35.9%) and conduct disorder (25.5%). These were followed by obsessive compulsive disorder (OCD; 16.3%), depression (12.6%), tic disorders (13.6%), other anxiety disorders (e.g. separation anxiety and generalised anxiety disorder; 11.7%), social phobia (7.8%), enuresis or encopresis (7.8%), elective mutism (2.9%) and 'other' (e.g. psychosis, bipolar affective disorder, childhood emotional disorder; 4.6%).

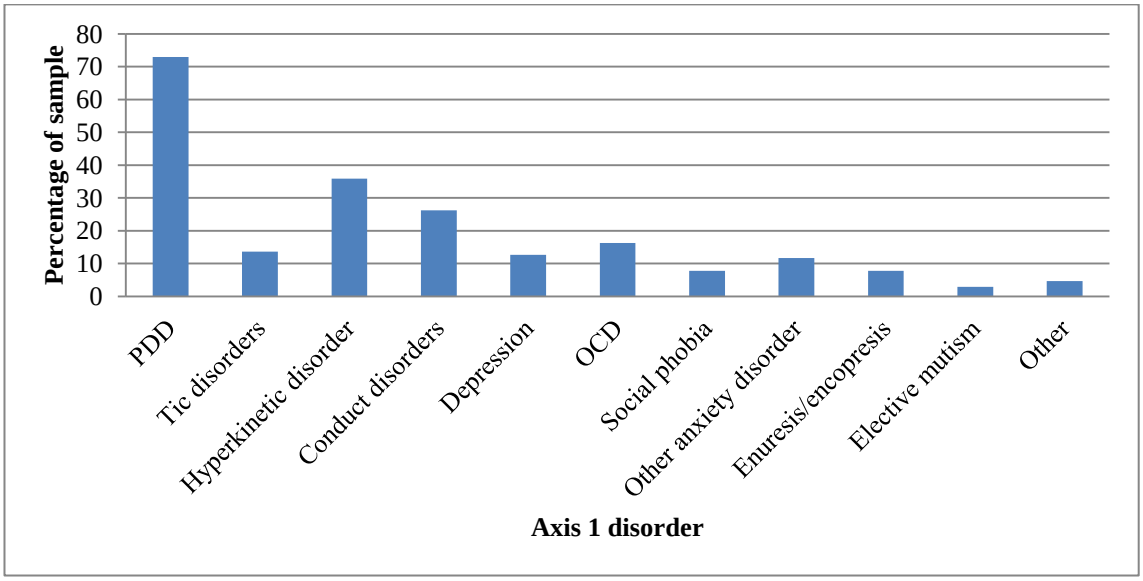

Figure 7. Distribution of axis 1 diagnoses for whole sample (*N* = 104).

4.2.2 Multi-axial diagnostic profile and comorbidity: change over time

Table 5 compares data on multi-axial diagnostic profile and comorbidity between the early and late time periods. Overall, there was little change in diagnostic profile over time. There were comparable rates of axis one comorbidity, diagnoses of PDD, medical comorbidity, presence of issues in social environment and overall clinical severity. However, fewer young people presented with a learning disability in the late than in the early time period (0% versus 20.7% respectively), $\chi^2(1) = 6.91$, $p = .012$. This suggests that a greater number of cognitively higher-functioning children are being seen in the later time period.

	Early (*N* = 30)	**Late (*N* = 30)**
Axis 1		
Met criteria for PDD	23/30 (79.3%)	21/30 (72.4%)
Mean number of diagnoses	2.36 (SD = 1.45; *N* = 28)	2.24 (SD = 1.09; *N* = 29)
Percentage with comorbidity (more than 1 axis 1 disorder)	19/27 (70.4%)	20/28 (71.4%)
Axis 2 (Specific disorder of psychological development	16/29 (55.2%)	13/28 (41.4%)
Axis 3 (Learning disability)	6/29 (20.7%)	0/28 (0%)
Axis 4 (Medical condition)	16/29 (55.2%)	16/28 (55.2%)
Axis 5 (Issues in social environment)	26/29 (89.7%)	27/28 (93.1%)
Mean CGAS score	47.63 (SD = 9.14; *N* = 19)	46.85 (SD = 7.35; *N* = 28)

Table 5. Comparison of multi-axial diagnostic profiles over the two time periods.

Figure 8 shows distribution of axis diagnoses over time. Significantly fewer tic disorders were seen in the later time period, $\chi^2(1) = 5.22$, $p = .026$, although there was no significant change over time for other diagnoses.

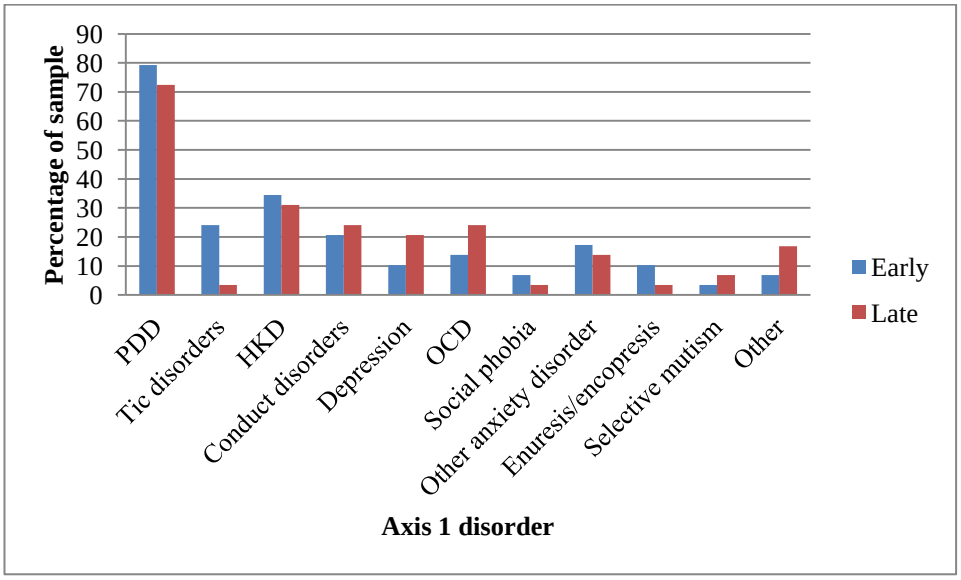

Figure 8. Distribution of axis 1 diagnoses over the early (N = 29) and late (N = 29) time periods.

4.2.3 Multi-axial diagnostic profile and comorbidity: comparison by gender

Table 6 compares the multi-axial diagnostic profile between males and females. Males had a significantly higher rate of comorbidity, $\chi^2(1) = 4.84$, $p = .031$, and a higher mean number of diagnoses, $U = 580.500$, $z = -3.364$, $p = .001$. However, there was no difference in the rate of PDD diagnoses, the rate of diagnoses on axes 2-5, or overall clinical severity. There were no significant differences in subtypes of ASD diagnoses between males and females.

Multi-axial profile	Male (*N* = 83)	Female (*N* = 23)
Mean no. of diagnoses	2.33 (SD = 1.17; *N* = 83)	1.43 (SD = 1.248; *N* = 21)
Axis 2	29/83 (34.9%)	10/22 (45.5%)
Axis 3	13/83 (15.7%)	6/22 (27.3%)
Axis 4	45/83 (54.2%)	15/22 (68.2%)
Axis 5	75/83 (90.4%)	16/22 (72.7%)
Mean CGAS	46.77 (SD = 8.85; *N* = 69)	50.88 (SD = 12.56; *N* = 17)
%comorbidity	59/82 (72.0%)	7/16 (43.8%)
PDD diagnosis	64/84 (76.2%)	14/23 (60.9%)
• Childhood autism	12 (14.5%)	4 (19.0%)
• Atypical autism	6 (7.2%)	1 (4.8%)
• Childhood disintegrative disorder	1 (1.2%)	0 (0%)
• Asperger's syndrome	13 (15.7%)	1 (4.8%)
• PDD other	23/64 (27.7%)	7 (33.3%)
• PDD unspecified	9/64 (10.8%)	1(4.8%)
• Risk	3.06 (SD=1.47; *N*=52)	2 (SD=1.08; *N*=13)

Table 6. Comparison of multi-axial diagnostic profiles between males and females.

Figure 9 compares the distribution of axis one diagnoses by sex. Males had a significantly higher rate of tic disorder, $\chi^2(1) = 3.904$, $p = .038$, hyperkinetic disorder, $\chi^2(1) = 10.31$, $p = .001$, and conduct disorder, $\chi^2(1) = 5.775$, $p = .011$. Females had a higher rate of social phobia, $\chi^2(1) = 5.185$, $p = 0.04$.

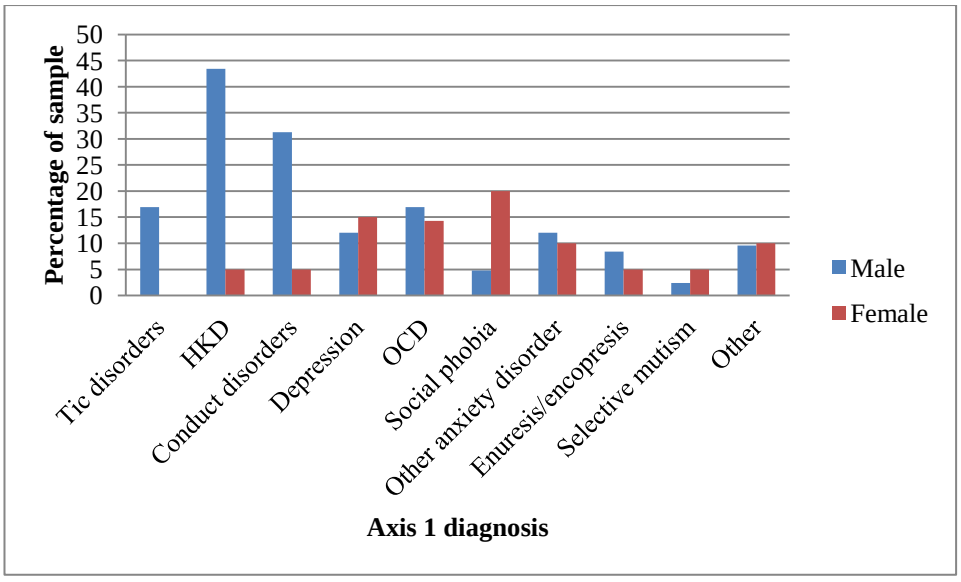

Figure 9. Comparison of axis 1 diagnosis distribution between males (*N* = 84) and females (*N* = 22).

4.2.4 Multi-axial diagnostic profile by PDD diagnosis

Table 7 compares the multi-axial diagnostic profiles between children who received a diagnosis of PDD and those that did not. Children who received a diagnosis of PDD had significantly higher rate of comorbidity than those who did not, $\chi^2(1) = 6.183$, $p = 0.14$. They also had a significantly higher level of overall clinical severity score on the CGAS, $U = 491.500$, $z = -2.276$, $p = .023$. There were no significant differences between the two groups in rates of diagnoses on axes 2-5.

	No PDD diagnosis (*N* = 29)	**PDD diagnosis (*N* = 76)**
Mean no. of diagnoses	1.39 (SD = 1.13; *N* = 28)	2.42 (SD = 1.16, *N* = 76)
%Comorbidity	10/22 (45.5%)	56/76 (73.7%)
• Axis 2	13/29 (44.8%)	26/76 (34.2%)
• Axis 3	4/29 (13.8%)	15/76 (19.7%)
• Axis 4	18/29 (62.1%)	42/76 (55.3%)
• Axis 5	25/29 (86.2%)	66/76 (86.8%)
• Mean CGAS	51.52 (SD = 11.93; *N* = 23)	46.14 (SD = 8.48; *N* = 63)

Table 7. Comparison of multi-axial diagnostic profiles between those who received a diagnosis of PDD and those who did not.

Figure 10 compares the distribution of axis 1 diagnoses between those who received a diagnosis of PDD and those who did not. Those without a PDD diagnosis had a significantly higher rates of enuresis or encopresis, $\chi^2(1) = 5.905$, $p = .028$. No significant differences were found for other diagnoses.

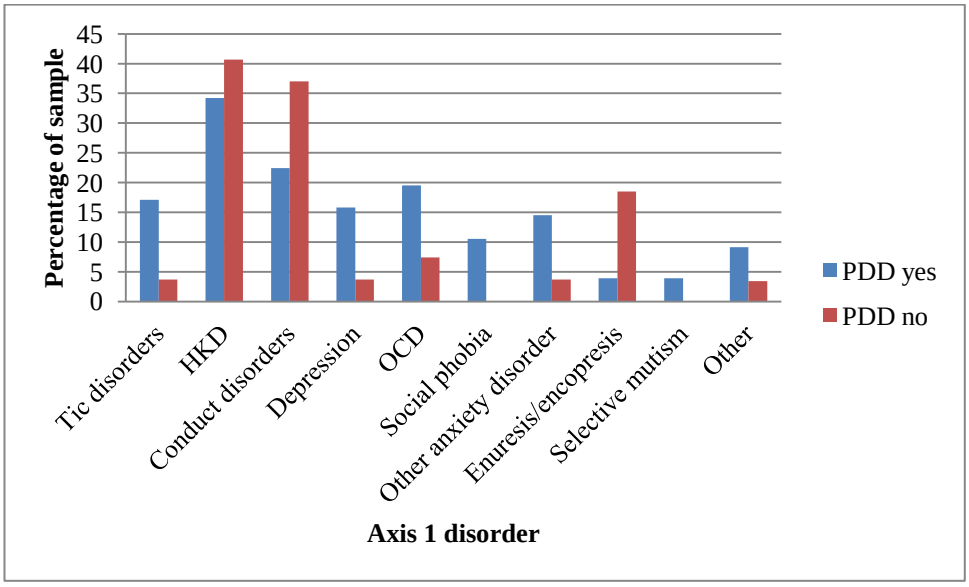

Figure 10. Comparison of percentages of axis 1 diagnosis distribution between those who received a diagnosis of PDD (*N* = 77) and those who did not (*N* = 27).

4.2.5 Age and psychiatric comorbidity

A Spearman's rho correlation was performed to explore whether certain conditions were associated with the child's age group. Older children (over 10 years old) were more likely to receive diagnoses of depression (r = .257, p = .005), OCD (r = .203, p = .022), social phobia (r = .178, p = .039) and 'other' anxiety disorders (r = .275, p = .003). Younger children (10 years or younger) were more likely to have hyperkinetic disorder (r = -.318, p = .001), oppositional or conduct disorder (r = -.218, p = .015) and enuresis or encopresis (r = -.196, p = .026).

4.2.6 Other indicators of complexity of clinical presentation

This section examines other variables thought to contribute towards complexity of clinical presentation. Table 8 shows the proportion of children with developmental delay for the whole sample and for the early and late time points. Overall, 62.6% of the sample had delayed milestones and 46.9% had delayed language development. Regression or loss in skills were reported in 20% of the sample. For most children, concerns were first noted when the child was approximately 1-2 years old. A significantly higher rate of developmental delay was found in the earlier time period, $\chi^2(1) = 4.767$, p = .028.

	Whole sample (*N* = 109)	**Early (Jan '07-June'08; *N* = 26)**	**Late (Jul '09 – May '10; *N* = 29)**
Developmental delay	62/109 (62.6%)	20/26 (76.9%)	14/29 (48.3%)
Delayed language	46/98 (46.9%)	15/26 (57.7%)	11/28 (39.3%)
Regression or loss of skills	19/95 (20%)	7/23 (30.4%)	4/28 (14.3%)
Age of first concerns (mode)	13-24 months (*N* = 97)	12 months (*N* = 24)	0-12 & 13-24 months* (*N* = 28)

Table 8. Developmental profile for whole sample and comparisons between early and late time periods. *Multiple modes exist therefore both are shown.

Table 9 shows other complexity indicators for the whole sample in terms of additional support from other services (Social Services and police/YOT), previous psychological treatment and level of risk assessed.

	Whole sample	**Early**	**Late**
Social services involvement	31/105 (29.5%)	11/29 (37.9%)	3/30 (10%)
YOT Involvement	11/105 (10.5%)	3/29 (10.3%)	3/30 (10%)
Statement of Educational Needs	55/103 (53.4%)	22/28 (78.6%)	9/29 (31%)
Previous treatment	35/90 (38.9%)	7/20 (35%)	14/30 (46.7%)
SLaM risk assessment	2.85 (SD = 1.46; *N* = 65)	3.00 (SD = 1.57; *N* = 18)	3.14 (SD = 1.49; *N* = 21)

Table 9. Other complexity indicators for whole sample and across the two time points.

Children in the early time period had significantly more social services involvement than the later time period, $\chi^2(1) = 6.356$, $p = 0.12$, and were more likely to have a Statement of Special Educational Need, $\chi^2(1) = 12.98$, $p = .000$. Children in both groups were comparable in terms of police or YOT involvement, prior psychological therapy and risk.

No differences were found when comparing males and females on Social Services, Police or YOT involvement, previous psychological treatment or having a Statement of Special Educational Need. However, males had a higher overall level of risk than females (3.06 versus 2.00 respectively), $t(24.53) = 2.92$, $p = .007$.

4.2.7 Family history of ASD

Table 10 presents data on the family history of ASD for the whole sample (indexed by having relatives with an ASD diagnosis or showing ASD traits). Approximately one third of the sample had a family history of ASD.

Whole sample	Number (percentage)
Family history of ASD	32/103 (33.3%)
Sibling(s) with ASD	15/103 (14.6%)
Parent(s) with ASD	12/102 (11.8%)
Other relative with ASD	16/103 (15.5%)

Table 10. Family history of ASD for whole sample.

Of those who received a diagnosis of PDD, rates of family history of ASD were comparable with the whole sample (Table 11).

PDD diagnosis	Number (percentage)
Family history	23/74 (33.8%)
Sibling(s) with ASD	10/74 (13.5%)
Parent(s) with ASD	9/73 (12.3%)
Other relative with ASD	12/74 (16.2%)

Table 11. Family history for those who received a diagnosis of PDD.

4.2.8 Overall clinical complexity

A complexity composite score was computed for the whole sample and compared across the two time points. This comprised the total number of complexity indicators present for each child including: having more than one axis 1 disorder; disorder(s) on axes 2-5; a CGAS score of less than 50; previous psychological treatment; social services, police or YOT involvement; 'medium' or higher scores in three or more areas on a measure of risk; and having a Statement of Educational Need. Overall the mean complexity score was 4.86 (SD = 1.95, range = 0-10) and there was no significant change in complexity over time, $U = 349$, $z = -1.523$, $p = .128$. There was no difference in overall complexity between those who received a diagnosis of PDD and those who did not, $U = 1031$, $z = -.711$, $p = .477$. However males had a significantly higher complexity score than females, $U = 720.5$, $z = -2.284$, $p = .022$.

Clinical complexity composite score		
Whole sample	4.86 (SD = 1.95; *N* = 110)	
Time point	Early 5.2 (SD=1.83; *N*=30)	Late 4.73 (SD=1.68; *N*=30)
Gender	Males 5.08 (SD=1.96, *N*=86)	Females 4.08 (SD=1.72; *N*=24)
PDD diagnosis	Yes 5.08 (SD=1.69; *N*=78)	4.69 (SD=1.91; *N*=29)

Table 12. Complexity composite scores for the whole sample and then broken down by time point, gender and whether or not they received a diagnosis of PDD.

4.2.9 Summary

The sample was characterised by a clinically complex presentation in terms of high psychiatric and medical comorbidity, social difficulties and a moderate degree of interference in functioning. Overall clinical complexity remained stable over time although changes were seen in individual clinical characteristics (e.g. lower rates of learning disability, fewer tic disorders, lower rates of developmental delay and additional service need). A relatively high proportion (one third) of cases had a family history of ASD diagnosis or traits. Subgroup analyses revealed differences in clinical presentation between males and females and those with and without a PDD diagnosis.

4.3 Service-related characteristics

Table 13 summarises service-related characteristics for the whole sample. The mean waiting time for assessment was 111 days and mean waiting time for reports was 94 days. On average, five professionals tended to be involved in assessments, which typically included a consultant child and adolescent psychiatrist, specialist trainee registrar (STR), senior house officer (SHO), clinical psychologist and trainee clinical psychologist. The mean number of psychometric tests was 2, which tended to be tests of intellectual ability and educational attainment. Very few ASD specific tests were used (e.g. Reading the Mind in the Eyes, Strange Stories). A full risk assessment was completed in 67.4% cases. Intervention was recommended in almost 9 out of 10 cases, which was predominantly psychological intervention (e.g. CBT, behavioural management advice), followed by educational interventions (e.g. advice), medical interventions (e.g. medication for hyperkinetic disorder) and 'Other' (e.g. social skills training, family therapy). In approximately one quarter of cases it was explicitly stated that the ARD team

would implement the intervention. Further assessment was recommended in two thirds of cases (e.g. medical investigations, neuropsychological assessment, home or school visits).

	Whole sample (*N* = 105)
Waiting time for assessment (days)	111 (SD = 60; *N* = 88)
Waiting time for report (days)	94 (SD = 55.60; *N* = 82)
Number of professionals involved	4.58 (SD = .979; *N* = 102)
No. of assessments used	2.23 (SD = 1.958; *N* = 105)
ASD specific measures	0.19 (SD = .467; *N* = 99)
Risk assessment completed	64/91 (67.4%)
Intervention recommended	88/100 (88%)
Psychological	69/88 (78.4%)
Medical	31/88 (35.2%)
Educational	52/88 (59.1%)
Other	24/88 (27.3%)
ARD to offer (but not clear)	20/83 (24.1%)
Recommendations for further assessment	61/100 (61%)

Table 13. Service provision characteristics for whole sample.

Table 14 compares service-related characteristics over time. The mean waiting time for both assessments and reports decreased although this was not statistically significant, $U = 268.5$, $z = -1.83$, $p = .067$ and $U = 201$, $z = -1.161$, $p = .246$ respectively. The number of professionals involved in assessments remained the same. However, the number of psychometric tests administered increased, $U = 81.5$, $z = -5.602$, $p = .000$, as well as the use of ASD specific tests, $U = 251.5$, $z = -3.514$, $p = .000$. It appears that risk assessments were being completed more frequently in the later time period, although this increase was not significant, $\chi^2(1) = .355$, $p = .383$.

In terms of plans and recommendations, no significant differences were found over time. However, it appears that further assessments are being recommended less frequently and interventions are being recommended more frequently. Furthermore, it seems that medical interventions (e.g. medication) are being recommended less frequently, and educational interventions offered more frequently.

	Early (*N* = 30)	**Late (*N* = 30)**
Waiting time for assessment (days)	132.69 (SD = 65.29; *N* = 26)	100.79 (SD = 31.95; *N* = 29)
Waiting time for report (days)	105.62 (SD = 60.65; *N* = 21)	79.92 (SD = 43.94; *N* = 24)
Number of professionals involved in assessment	4.78 (SD = 1.25; *N* = 27)	4.7 (SD = 0.70; *N* = 30)
No. of assessments used	1.14 (SD = 0.79; *N* = 29)	3.9 (SD = 2.47; *N* = 30)
ASD specific assessments	0.04 (SD = 0.19; *N* = 29)	0.53 (SD = 0.68; *N* = 30)
Risk assessment completed	18/27 (66.7%)	20/27 (74.1%)
Intervention recommended	21/26 (80.8%)	27/29 (93.1%)
Psychological	17/21 (81%)	21/27 (77.8%)
Medical	8/21 (38.1%)	8/27 (29.6%)
Educational	11/21 (52.4%)	18/27 (74.1%)
Other	7/21 (33.3%)	7/27 (25.9%)
ARD to offer (but not clear)	4/17 (23.5%)	7/27 (25.9%)
Rec. for further assessment	18/26 (69.2%)	16/29 (55.2%)

Table 14. Service provision characteristics across two time points.

4.3.1 Summary of service-related findings

Service characteristics largely remained stable over time although there was a significant increase in the number of neuropsychological assessments administered. Most children were recommended further assessment and a higher proportion was recommended intervention.

5. Discussion and clinical implications

The present audit aimed to obtain an overview of the demographic, clinical and service characteristics of children and adolescents referred to the ARD Team and to explore change in these variables over time. Understanding and monitoring these characteristics helps services adapt to meet the needs of the population it serves. In this section, key findings will be discussed along with limitations and research and clinical implications from the audit.

5.1 Demographics and referrals

The majority of children and adolescents referred to the clinic were White-British and male. The male to female ratio of 4:1 reflects that of ASD in the general population (Fombonne, 2005; 2009). The service tends to see older children, with the mean age being eleven and a half, the age at which most children begin secondary school. Older children may represent more complex or difficult to diagnose cases as ASD difficulties may have been particularly subtle, atypical in presentation or, in the earlier years, masked by other difficulties (e.g. hyperkinetic or conduct disorder). This pattern could suggest that referrals are prompted when children enter the transitional stage of adolescence and face an increasing number of social and academic demands. The number of secondary school age children increased over time. This suggests that local services may be better at diagnosing younger children and therefore a higher number of older children are being referred.

Most referrals were national, originating mainly from other parts of London and the South East, and were made most frequently by consultant child and adolescent psychiatrists. Unexpectedly, the number of national referrals decreased over time whereas the number of local referrals increased. This increase may have been due in part to an agreement made with a local service in Croydon from which a series of referrals were received from in 2010, coinciding with the later time period. However, given findings of the increasing number of older children and those with potentially more subtle impairments being referred, it may also reflect local services referring such cases at a greater rate.

5.2 Clinical characteristics

Nearly three quarters of the children assessed in clinic met criteria for a pervasive developmental disorder, the most common of which was 'other pervasive developmental disorder'. As expected, there was a high rate of comorbidity with other axis one disorders, particularly hyperkinetic disorder, anxiety disorders and oppositional or conduct disorders. The overall psychiatric comorbidity rate of 67.3% is similar to that found by Ghaziuddin *et al.* (1998) of 65% and Simonoff *et al.* (2008) of 70.8%. The rate of hyperkinetic disorder (35.9%) was higher than that of 28.3% found by Simonoff *et al.* (2008) although similar to Ghaziuddin *et al.*'s (1998) finding of 37% among children with Asperger's syndrome. There was a high rate of anxiety disorders (28.6%) which is lower than the estimated rate of 41.9% in Simonoff *et al.*'s (2008) study although substantially higher than among children and adolescents in the general population of 5% (King & Ollendick, 1997), and the rate of OCD was double that of Simonoff's study. The proportion of children with oppositional defiant or conduct disorder was also high (25.5%) although lower than the estimated rate of 30% found in Simonoff *et al.*'s (2008) study. The rate of depression in the present audit of 12.6% was higher than Simonoff *et al.*'s (2008) study (1.4%) although is lower than the rate of 17% found by Kim *et al.* (2000) and 37% found among children with Asperger's syndrome (Ghaziuddin *et al.* 1998).

The sample was also complex in terms of presence of diagnoses on other axes. Specific disorders of psychological development were common and one fifth had a learning disability, which is lower than population prevalence which is estimated to range from 25.8 to 71.3% (O'Brien & Pearson, 2004). Nearly two thirds had a comorbid medical condition and a high number of children had issues present in their social environment; such as anomalous parenting and familial discord, parental mental health difficulties and bullying. With regard to overall clinical severity, the mean CGAS score corresponded to a 'moderate degree of interference in functioning in most social areas or severe impairment in functioning in one area' (Shaffer *et al.*, 1983).

Over time, there was little change in the clinical characteristics of children and adolescents. A lower rate of tic disorders was found in the late time period although there was no significant change over time in other diagnoses. However, exploratory analyses revealed that hyperkinetic disorder was more common in younger children whereas depression and anxiety disorders were more prevalent among older children. This is consistent with existing literature suggesting that

the types of diagnoses presenting alongside ASD vary according to the child's age and developmental stage (Ghaziuddin *et al.*, 1998; Sukhodolsky *et al.*, 2008). There was a decrease over time in the number of children with learning disabilities, indicating an increase over time in the number of children who were cognitively high-functioning. Males had a higher rate of psychiatric comorbidity than females and were more likely to have diagnoses of tic disorders, hyperkinetic disorder and conduct disorder. Females were more likely to have social phobia. Those who received a diagnosis of PDD also had a higher rate of comorbidity and a higher level of clinical severity on the CGAS than those who did not.

Over time, there was a decrease in the rate of developmental delay, a key diagnostic criterion for ASD. A lower rate of developmental delay suggests subtler yet impairing difficulties that are more difficult for local services to diagnose. Children in the early time period also had a higher rate of social services involvement and were more likely to have a Statement of Educational Need. This could reflect a social worker having left the team during the sampling period and therefore standard questions to assess level of risk not being asked. Approximately one third of the sample had a family history of ASD diagnoses or traits. Males and females were comparable on these characteristics although males had a higher level of risk.

Contrary to expectations, there was no change in the composite measure of clinical complexity over time. It is possible that this represents consistently high levels of complexity which may be expected for a National and Specialist service. However, on reflection it may have also reflected an inadequate operationalisation of complexity, which was therefore insensitive to change. Clinical complexity was defined in terms of additional needs and difficulties and a higher level of clinical severity. However, complexity in ASD may potentially be better conceptualised as difficulty in receiving an accurate diagnosis due to have more atypical or subtle manifestations that have gone undetected or been masked by other difficulties. Males had a higher complexity score than females.

Although there was no change in the overall complexity score, some of the variables which changed over time may be indicators of complexity in ASD. For example, that children tended to be older over time implies that an increasing number of children are being seen whose symptoms had gone undetected for longer and therefore were perhaps harder to detect by local services earlier on. Symptoms may become more apparent as children face the difficult transitional stage of adolescence and secondary school and when other difficulties (e.g. anxiety

and depression) emerge. Moreover, an increase in cognitively high-functioning children suggests a more complex presentation as greater cognitive and linguistic abilities may conceal underlying developmental difficulties. These demographic and clinical changes may reflect a different conceptualisation of complexity in children and adolescents with ASD.

5.3 Service-related characteristics

There was little change over time in service characteristics, with the only significant differences being an increase in the number of psychometric assessments carried out. On inspection of descriptive data across the time points it can be seen that waiting times for assessments and for reports were lower in the later time period and that the number of risk assessments completed was higher. Although change in these variables was not statistically significant, it is promising for future service provision if waiting times continue to decrease and the number of risk assessments carried out increases.

5.4 Limitations

Aside from the operationalisation of complexity, additional limitations need to be considered when drawing conclusions and implications from this audit. First, 22 cases were excluded, which may decrease the representativeness of the findings. Second, particular variables were difficult to assess due to information being missing from files or unclear reporting of information (e.g. dates of reports, details of diagnoses and treatment recommendations). Third, the sampling period (three years) may have been an insufficient in assessing change in complexity.

5.5 Implications

Three main implications arise from the present audit in terms of the future of the ARD team service provision. First, given that an increasing number of older children are being seen in the clinic, it is important that the team has the skills and expertise in working with older children. This may include providing support around making transitions into adolescence, coping with secondary school and interventions for difficulties associated with increased age such as

depression and anxiety. Second, it is important that support is provided for the transition into young adulthood and that young people are linked in with appropriate services when they reach eighteen. Findings highlight the relevance of proposals set out in the recent Autism Act 2009, emphasising the need for transition services. It may be useful for the team to promote awareness of these issues to other agencies and provide consultancy in managing them.

Third, although in the present audit some characteristics indicative of clinical complexity increased (e.g. age, cognitive ability), it remains important for the ARD team to work with local services in developing skills in assessment of less complex cases so that the ARD service can dedicate its resources to diagnosing and managing the most complex cases. Given that the number of national referrals has decreased and the number of local referrals increased, the team should work to support local services in developing skills in recognising and diagnosing ASD among those with subtler presentations (including older children with less obvious impairments) It should also aim to promote awareness of the service among national (non-SLaM) services to increase national referrals.

It is recommended that in order for the service to develop and to adapt to changes in the needs of children and adolescents referred, future audits are conducted assessing further change in demographic, clinical and service characteristics. Improving the recording of variables listed above should be considered to make it easier to monitor these characteristics (e.g. diagnoses, report dates, treatment provision). Future research could also investigate more thoroughly what constitutes complexity among individuals with ASD and therefore how it can best be operationalised. For example, by investigating factors that complicate diagnosis or treatment and using factor analytic methodologies. It could also look more closely at variables such as reason for referral (e.g. what proportion is second opinions) and treatment outcomes.

5.6 Conclusion

In conclusion, this audit enables the ARD service to better understand the demographic, clinical, characteristics and associated needs of children and adolescents referred, and has highlighted areas of potential growth and development. The young people referred to the service have a complex clinical presentation, which is consistent with its purpose. The service needs to ensure it is equipped to recognise and manage issues associated with an increasing number of older

children being referred, as well as continuing to meet the needs of younger children. Results will be fed back to the team through a formal presentation and a written summary.

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Appendix: Data collection pro forma

Demographics:

ID	
Sex	
Date of Birth	
Twin?	Yes/ No
Ethnicity and code	
Consent to be contacted for research	Yes/No

Referral

Date of referral	
Reason for referral	ASD assessment / TS / Treatment / Other
Referring source	CCAP / Psychology / Paeds/ Other
County/PCT	
Date of assessment	ADI: ADOS: Psychometry:
Date of report	Medical Report: Psychology Report:

Clinical Characteristics:

Background:

First concerns noted	Age (months):
Delayed milestones?	Yes/ No / NS
1) Language delay	Yes/ No / NS
First words (months):	
First sentences (months):	
2) Motor skills delay	Yes/ No / NS
3) Bladder/ Bowel control delay	Yes/ No / NS
Regression / Loss of skills?	Yes/ No / NS

Current/previous psychological treatment:

Yes / No / NS	**Circle those that apply:** Behavioural therapy/ Cognitive behavioural therapy/ Counselling (Parent/child) / Parenting work / other (specify):

Current medication

Yes / No / NS	If yes, please specify:

Family History

Code 'D' if actually diagnosis given; Code 'T' if subjective trait given

	Sibling	Mother	Father	Distant
ASD				
Developmental Disorders				
Social phobia				
Obsessive compulsive Disorder				
Other anxiety disorder				
Depression				
Schizophrenia				
BPD				
Anorexia Nervosa				
Other (look at ICD 10 key below) please state: ……				

Other important relevant family history:

Number of services currently or previously involved

CAMHS	Yes/ No
Paeds	Yes/ No
Psychology	Yes/ No
SALT	Yes/ No
OT	Yes/ No
Safeguarding/ LAC/ social care	Yes/ No
Forensic / Police / YOS / YISP	Yes/ No
Other	Yes/ No (specify):
Number (and type) of professionals involved in ARD assessment:	Number: Type (please circle): CCAP/ Psychologists / Mental Health Worker / Social Worker / SALT / SPR / SHO / TCP / Other:

Educational needs

Does the child attend a mainstream or special needs school?	Mainstream / Special
Does the child have a Special Educational Needs statement?	Yes / No
If not, does the child receive support in school? (e.g. School Action and School Action plus, LSA/classroom support)	Yes / No Please specify:

Multi-axial diagnosis

Axis I	***clinical psychiatric syndromes***		**ICD-10 Key** F00-F09 Organic, including symptomatic, mental disorders F10-F19 Mental and behavioural disorders due to psychoactive substance use F20-F29 Schizophrenia, schizotypal and delusional disorders F30-F39 Mood [affective] disorders F40-F48 Neurotic, stress-related and somatoform disorders F50-F59 Behavioural syndromes associated with physiological disturbances and physical factors F60-F69 Disorders of adult personality and behaviour F70-F79 Mental retardation F80-F89 Disorders of psychological development F90-F98 Behavioural and emotional disorders with onset usually occurring in childhood and adolescence F99 Unspecified mental disorder
Axis II	***specific disorders of psychological development***		
Axis III	***intellectual level / cognitive functioning***		
Axis IV	***medical conditions***		
Axis V	***social environment***		
Axis VI	***psychosocial disability / impact***		

Psychometric assessments

How many psychometric assessments used?	
Of these - how many were ASD specific?	

IQ test: Yes / No

Test used	VIQ / VCI	PIQ / PRI	FSIQ / GAI	Discrepant profile? (e.g. VIQ>PIQ)

Developmental assessment (e.g. Mullen, Bayley, Vineland): Yes / No

Test used	Standard score	Test age equivalent

Adaptive behaviour scale: Yes / No

Scale used	General composite	Percentile	Age equivalent

Attainment Test: Yes / No

Attainment test and subtest used	Standard Score	Percentile	Age equivalent

Language tests: Yes / No

Language test used	Date	Standard Score	Percentile	Age equivalent
Expressive:				
Receptive:				

Other neuropsychological test: Yes / No

Neuropsychological test and subtest used	Date	Standard Score	Percentile	Age equivalent if relevant to test

Additional psychometric tests administered?: Yes / No

Additional Psychometric test used (specify):	

SCQ completed: Yes / No

SCQ	Parent Score:

Connors completed: Parent Yes / No Teacher Yes / No Self Report Yes / No

Parent Connors

Positive Impression : probably valid / possibly invalid / probably invalid (circle)
Negative Impression : probably valid / possibly invalid / probably invalid (circle)

Inattention (T-score)	Hyperactivity/ Impulsivity (T-score)	Learning Problems (T-score)	Executive Functioning (T-score)	Aggression (T-score)	Peer Relations (T-score)

Teacher Connors

Positive Impression : probably valid / possibly invalid / probably invalid (circle)
Negative Impression : probably valid / possibly invalid / probably invalid (circle)

Inattention (T-score)	Hyperactivity/ Impulsivity (T-score)	Learning Problems / Exec Functioning (T-score)	Aggression (T-score)	Peer Relations (T-score)

Self Report Connors

Positive Impression : probably valid / possibly invalid / probably invalid (circle)
Negative Impression :probably valid / possibly invalid / probably invalid (circle)

Inattention (T-score)	Hyperactivity/ Impulsivity (T-score)	Learning Problems (T-score)	Aggression (T-score)	Family Relations (T-score)

SDQ completed: Yes / No

(**Score with initials i.e. VH = Very high / VL = Very Low)**

SDQ	Parent	Teacher	Self Report
Overall stress			
Emotional distress			
Behavioural difficulties			
Hyperactivity and attention deficits			
Difficulties getting along with others			
Kind and helpful behaviour			
Impact of difficulties on young person's life			

(Score with initials i.e. Very high etc)

Diagnostic predictions	
Any diagnosis	
Emotional disorder (anxiety/depression etc.)	
Behavioural disorder	
Hyperactivity or concentration disorder	

DAWBA completed: Yes / No

Who by? Parent / Teacher / YP

Diagnostic Predictions	**ICD-10**
Autism Spectrum	
Separation Anxiety	
Specific Phobia	
Social Phobia	
Panic	
Agoraphobia	
PTSD	
OCD	
Generalised Anxiety	
Depression	
Deliberate self Harm	
Emotions at school	
Hyperactivity	
Oppositional	
Conduct	
Anorexia / Bulimia	
Tics	
Other concerns	

ADI completed: Yes / No

ADI	**Algorithm scores**		**Algorithm scores**
A1		B1	
A2		B4	
A3		B2 (v)	
A4		B3 (v)	
Total A cutoff = 10		Verbal Total B cutoff = 8	
		B1	
		B4	
		Non-verbal Total B cutoff = 7	
C1			
C2			
C3			
C4			
Total C cutoff = 3			
Total D cutoff =1			

If ADI not fully completed, please give reason:

ADOS – Module 1 2 3 4 (circle as appropriate)

ADOS algorithm scores (NB not all will apply to all modules)		**Module algorithm**
A1		
A2		
A3		
A4		
A5		
A6		
A7		
A8		
A9		
A10		
		A. Communication Total:
B1		
B2		
B3		
B4		
B5		
B6		
B7		
B8		
B9		
B10		
B11		
B12		
		B. Social Interaction Total:
		A+B. Communication + Social Interaction Total:
C1		
C2		
		C. Imagination/ Creativity Total:
D1		
D2		
D3		
D4		
D5		
		D. SB and RI Total:
E1		
E2		
E3		
ADOS classification:		

Level of risk:

Was a risk assessment completed?	Yes / No
Date:	Yes / No
Child protection register (CPR)? (please state details)	Yes / No
Risk in family? E.g. sibling CPR, parental mental health or substance misuse	Yes / No
Number of areas (out of 6) containing scores at or above medium risk level:	
Further action needed based on risk (e.g. assessment/management plan, referral to SS)	Yes / No

Recommendations:

Recommendations for intervention: Yes / No

CBT	Yes / No	ARD Team / local service / other team / not specified
Behaviour therapy	Yes / No	ARD Team / local service / other team / not specified
Psychoeducation	Yes / No	ARD Team / local service / other team / not specified
Parenting intervention (e.g. behaviour management, parenting course)	Yes / No	ARD Team / local service / other team / not specified
Medical treatment (e.g. medication)	Yes / No	ARD Team / local service / other team / not specified
Educational advice	Yes / No	ARD Team / local service / other team / not specified
Other (please specify):	Yes / No	ARD Team / local service / other team / not specified

Recommendations for further assessment: Yes / No

Psychological assessment	Yes / No	ARD Team / local service / other team / not specified
Psychometric assessment	Yes / No	ARD Team / local service / other team / not specified
Cytogenetic testing	Yes / No	ARD Team / local service / other team / not specified
Other medical (please specify):	Yes / No	ARD Team / local service / other team / not specified
Home assessment	Yes / No	ARD Team / local service / other team / not specified
School assessment	Yes / No	ARD Team / local service / other team / not specified
Further ASD assessment?	Yes / No	ARD Team / local service / other team / not specified
Other (specify):	Yes / No	ARD Team / local service / other team / not specified